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PERSONALITY CHARACTERISTICS AS ACHIEVEMENT PREDICTORS
OF BASIC SKILLS IN THE JUNIOR HIGH SCHOOL

by



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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL, 1971

THE UNIVERSITY OF ALBERTA
FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled Personality Characteristics as Achievement Predictors of Basic Skills in the Junior High School submitted by William L. Cousens in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

This study investigated the improvement in prediction of achievement in the basic skills and the discrimination of students in achievement-level groups when personality variables were combined with intelligence variables as predictors. A junior high school population of 552 was given a criterion test, the Canadian Test of Basic Skills, and two predictor tests, the Lorge-Thorndike Intelligence Test Level 4A and the California Psychological Inventory.

A multiple regression analysis was conducted on the criterion sample and the regression systems established from this analysis were tested on the cross-validation sample. A comparison of regression systems containing only intelligence variables with those containing both personality and intelligence variables indicated practical significance in prediction had been achieved by addition of the personality variables.

Achievement-level groups (low, middle, high) were developed by employing the standard error of estimate as a basic unit of measure. A two vector discriminant analysis employing the personality variables as loading factors was employed to discriminate students within the achievement-level groups. The results of this analysis were such that they could have occurred by chance, hence, it was not possible to develop discriminating personality patterns for the achievement level-groups.

ACKNOWLEDGEMENTS

I wish to thank Dr. B. R. Corman for his assistance and guidance throughout this study. My thanks also to Dr. J. E. Bicknell and Dale Burnett for their work on the statistical analysis and the computer programs.

I would especially like to thank Walter Muir, University of Victoria, for his assistance in preparing the data for the computer analysis.

Finally, I would like to express my thanks to my wife, Barbara, for her unyielding patience, understanding, and encouragement.

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CHAPTER ONE

INTRODUCTION

The Nature of the Problem and Its Importance

During recent years there has been an increasing emphasis placed upon individualizing instruction in the elementary and secondary schools (Lindvall and Bolvin 1967; Cooley and Glasser 1969). Bouchard (1970) states that individualized instruction may be defined as the interaction between a student and a teacher which results in the adjustment of the learning experiences to the unique interest, capabilities, and needs of the student. Adjustments to the classroom learning experiences may be brought about if characteristics impinging upon academic performance can be identified and measured.

If individual adjustments in the classroom learning experiences are to be brought about, then a number of questions must be considered. What are the learning-related characteristics of pupils which should be taken into consideration? What are the teaching-related characteristics of teachers which significantly influence the students? Can adequate descriptions of these characteristics be developed? Can measures of these characteristics be combined with measures of intelligence to obtain improved estimates of reasonable expectations for the achievement of individual pupils? Is it possible, on the basis of the measures of these characteristics and intelligence, to identify groups of students exhibiting similar characteristics who may be matched with a teacher exhibiting complementary characteristics? These do not exhaust the

questions involved, nor will they all be explored in this study. The questions do serve to indicate the complexities involved if the individualization of instruction is to be undertaken.

The particular personalities involved in the interactions within a school classroom should influence the nature and the productivity of a learning experience. Interactions with the teacher, with the other pupils, and the individual's ability or lack of ability to cope with these interactions should influence the academic achievement of individuals. An understanding or an awareness of the personality profile of each of the individuals within each classroom should allow instruction and personal interactions to be channelled towards development of each student's potential.

If the trait-and-type method is employed to define an adolescent's personality, and since the personality structure of an adolescent is defined as being ego-centered, then personality factors may have a great influence upon the academic performance of the individual adolescent. Ausubel (1954, pp. 23) suggests that an adolescent's conception of his own importance; his drive for self-enhancement; his need for status; his degree of dependence or independence; his ability to control his environment; his ability to assimilate new values; his concept of his capacity for doing things for himself; his need for self-esteem; his feelings of security; his need for immediate gratification; his sense of moral obligation and responsibility; his types of defences employed when threatened; all influence academic performance.

The expression by the student of these characteristics may influence the manner in which the adolescent accepts and is accepted by

others; the manner in which the adolescent learns or fails to learn; and the manner in which the adolescent matures or fails to mature. For these reasons it was decided to focus this study upon the relationships among personality characteristics, intelligence, and academic achievement of junior high school students.

Statement of the Problem

It was proposed to assess the relationships between the academic performance of junior high school pupils and certain selected personality traits which they possessed. If significant relationships were found to exist, then the first purpose of this study was to develop systems for the prediction of academic performance based upon these relationships. The second purpose of the study was to determine whether there were patterns of personality traits which were typical of each of three achievement-level groups; high, middle, and low-achievers.

Limitations of the Study

This study was exploratory in nature, and was confined to one average sized junior high school in Edmonton, Alberta. Therefore, the analysis represents only students drawn from that particular area of one city and is not a random representation of the junior high school population.

The criterion achievement variables were limited to those areas which are contained in the Canadian Test of Basic Skills. The predictor variables were limited to the eighteen subtests of the California Psychological Inventory and the two measures of the Lorge-Thorndike Intelligence Test Level 4 A.

Although the ultimate aim of the study was to provide data supportive of the desirability of forming groups on the basis of personality congruence among all members of the group, no attempt was made here to form such groups. This study was confined to the identification of prediction systems and description of differences of achievement-level groups.

A review of the literature pertinent to the purposes of the study, of studies descriptive of the criterion and predictor variables, and null-hypotheses formulated are contained in Chapter Two.

CHAPTER TWO

REVIEW OF LITERATURE

This chapter contains a review of the literature pertinent to the purpose of this study; a review of the literature pertinent to the criterion and predictor variables; and the two null hypotheses proposed as a result of this review.

Literature Pertinent to Purpose of the Study

The ultimate goal of this study is the formation of classroom groups through the matching of students and teachers by complementary personality patterns. Students are placed into groups commencing in pre-school kindergarten by means of geographical boundaries and school entry age; into divisions of large over-all enrollment into schools, grades, and classes; and finally into subgroups within the academic subject areas. The breakdown of the formal class into instructional groups such as ability grouping, has received and continues to receive a considerable amount of administrative attention. One criterion, that of grouping on the basis of personality has received little administrative attention.

Herbert A. Thelen (1959) feels that learning can be greatly enhanced by matching pupils to teacher on the basis of personalities to produce a climate of "oneness" in the classroom. He has developed three main principles to be followed in the selection of such groups.

Compatibility or Congruence. The fit between the teacher and the groups is most important. A class or group should be formed

exclusively of that type or range of student personalities with whom the teacher is most effective.

Communality or Homogeneity. The student groups should be formed around common ability, values and concepts.

Complementation or Combination. The formation of such groups should take into consideration individual differences.

These three principles are not mutually exclusive, but rather apply simultaneously to any one group. For example;

We are trying to assemble students that Miss Jones can teach; Miss Jones teaches English; English has certain objectives; the course of study calls for certain activities; the activities involve a particular set of expectations for overt participation; a specific set of demands for learning and for dealing with a defined body of information. (Thelen, 1959)

The number of variables to be considered in group formation is both extensive and varied. However, Thelen (Yates, 1966) has suggested that the actual group formation should be governed by six major variables:

1. The student's value-attitude system.
2. The student's sophistication and maturity vis-a-vis the subject studied.
3. The sort of teacher with whom the student can identify.
4. The student's susceptibility to threat from other students.
5. The student's generalized tendencies to deal with stress.
6. The student's goal in the special sense of the kind of experiences he seeks.

Having set his criteria for group selection, Thelen then turned to a practical demonstration in an attempt to identify student types.

He asked several teachers to classify their students according to the teacher's own insight into each of the student's personality. The results of their classification indicated four major student types: good, bad, indifferent, and lost. However, it was soon discovered that each type actually represented a continuum and that several subtypes existed between its two poles. Some twenty-six personality descriptions were finally identified from the original four personality groups. (Thelen, 1967b)

Twenty-six personality variables proved to be too unwieldly and Thelen (1967a) discarded this approach in favour of a test battery which he devised. However, he found, upon factor analysis, that though he had been successful in identifying ten factors, none acted significantly alone and several of the factors influenced each personality type.

Thelen (1967b) then returned to his teacher group and a third approach. Each teacher was instructed to construct a description of a student type who, in the teacher's mind, had received the greatest benefit from the teacher's course in the past. From the various descriptions compiled by each teacher a single student description was created and employed as an "ideal" student for each specific teacher. Students were then assigned to the teacher according to his student model and the resultant class was labelled a "Teachability Group". Such groups, when compared to control groups, proved to have greater solidarity, were more work-oriented, were less inattentive, were less distractable, and were more manageable. Teachability Groups seemed to have a greater sense of common purpose, allowed the teacher to give more of himself, and in a majority of cases were characterized by higher grades.

Based on the proposition that the particular personalities in the classroom are, in fact, important conditions which influence the nature and productivity of classroom experience, Thelen aims at 'teachability' or 'facilitative' grouping. . . . The central proposition of Thelen's approach is that the teacher does a better job with some pupils than with others, and it makes sense to provide the teacher with a class of those students with whom he is found to do a good job. Essentially it involves giving each teacher a class full of students who are like those he believes have in the past got a lot out of his class. (Yates, 1966, pp. 73-74)

Beyond the work of Thelen, little research has been carried out in the area of matching teachers and pupils. There has been an indication by Koenig and McKeachie (1959) in Michigan that personalities are indeed important variables in the area of learning. However, they suggest that rather than excluding students from a particular teacher's class because of personality, the students be given special training and attention in order that they might learn in such a class.

Although the ultimate aim of this study is to provide supportive evidence for the eventual matching of teacher and student, similar to the work of Thelen (1967a, 1967b), no attempt was made to make such a match at this time. The limit of this study was an attempt to identify groups of students who exhibit particular discriminating personality patterns. If this is possible, then further research may uncover teacher personality patterns similar to those of the students and thus an eventual matching of teacher and student may be carried out. By employing the California Psychological Inventory, the Lorge-Thorndike Intelligence Test Level 4A, and the Canadian Test of Basic Skills, an attempt was made to provide formulae for the prediction of academic achievement and to identify discriminating personality patterns,

Literature Pertinent to the Criterion Variables

Canadian Test of Basic Skills. Since this testing instrument has only been available from the spring of 1967, very little research has been reported on it. Essentially the Canadian Test of Basic Skills is a Canadian version of the Iowa Test of Basic Skills. In a study (Nyberg, 1969) conducted on approximately 200 Edmonton, Alberta, junior high school students, it was found that there were very few differences between these two tests. The test manuals, test objectives, types of items, contents of sub-tests, names of sub-tests (except for mathematics) directions, numbers of items, and placement of test items on each page were almost identical. Only 24 of 628 items had been changed because of cultural differences, surnames, currency, and map symbols.

Nyberg (1969) reported split-half reliability coefficient estimates ranging from .69 to .92 for grade seven; .64 to .94 for grade eight; and .57 to .89 for grade nine. A factor analysis yielded two factors; one a general factor oriented toward verbal ability, the other toward non-verbal ability.

As both tests seem to be almost identical, it may be argued that the research reported on the Iowa Test of Basic Skills would also pertain to the Canadian Test of Basic Skills. Remmers (1959), in a review of the Iowa Test of Basic Skills stated: "No battery of achievement tests intended for civilian uses has been constructed with greater technical sophistication, greater adequacy of statistical base, and greater use of previous research (p. 36)." The validity and reliability of the Iowa version of these tests has been extensively documented (Buros,

1959) and although the Canadian tests have not yet been reviewed, they may be regarded as reliable as their Iowa counterparts.

Literature Pertinent to the Predictor Variables

The California Psychological Inventory (C.P.I.) might be thought of as a simplified version of the Minnesota Multiphasic Personality Inventory (M.M.P.I.). The C.P.I. contains 480 true-false items (twelve of which are duplicates), some taken from the M.M.P.I. and others written to tap social and personal attitudes and interests (Cronbach, 1959). The C.P.I. is a self-report instrument intended primarily for use with normal adults and adolescents. The function of the test profile is to furnish a summary of an individual's social-interaction. The profile indicates what sort of an individual a person is in the common sense meaning of personality (Liddle, 1958).

The C.P.I. has been employed for purposes of prediction in several areas. Holland (1959) employed the C.P.I. to explore the usefulness of non-intellectual factors in predicting college grades. He found C.P.I. scales which correlated at the .01 level with male grades both positively and negatively.

Keimowitz and Ansbacher (1960) found thirteen of the eighteen scales of the C.P.I. differentiated significantly between 29 mathematics over-achievers and 27 under-achievers at the grade eight level. Lessenger and Martinson (1961) obtained similar results in a comparison of gifted and average students at the grade eight and twelve levels. Pierce (1961) found five C.P.I. scales that significantly differentiated between his samples of high and low achieving tenth and twelfth grade boys.

In an attempt to predict academic success, Gough (1964) correlated the eighteen scales of the California Psychological Inventory and a measure of intelligence, with a grade point average of high school academic achievement. From the highest correlations, he developed a single regression equation for his total population based on C.P.I. factors alone, and another involving C.P.I. factors and an intelligence factor. The equations developed by Gough are:

1. C.P.I. factors alone.

$$\text{ACH} = .32 \text{ Re} + .19 \text{ So} - .31 \text{ Gi} + .23 \text{ Ac} + .28 \text{ Ai} + .24 \text{ Ie} + 20.12$$

2. C.P.I. factors plus intelligence.

$$\text{ACH} = .20 \text{ Re} + .24 \text{ So} - .13 \text{ Gi} + .19 \text{ Ac} + .18 \text{ Ai} + .28 \text{ I.Q.} - .79$$

Snider and Linton (1964) found that there appeared to be a coherent pattern between the responses of achievers and non-achievers in grades ten and eleven in a lower middle class Alberta district. Snider (1966) attempted to predict achievement and under-achievement in this same Alberta sample. He employed Gough's formula, but failed to obtain significant results. On the other hand, Linton (1967) defined a population of Alberta grade nine students who had written the government yearly examinations and he found that Gough's formula significantly distinguished between levels of academic achievement.

Domino (1968) employed two of the C.P.I. variables to demonstrate that different settings, such as conformance and independence, would produce differential predictive patterns. He formed the conclusion that:

. . . rather than fit the student to the curriculum as is presently the case, it might be extremely worthwhile to fit the curriculum to the student by providing each student with the type of setting which most effectively utilizes his potential (Domino, 1968, page 259).

Sister Mary Angelina Breaux (1964) suggests that there is nothing scientific in the manner in which student's grades are determined. Often the ability of the student to cope with interpersonal elements in the academic setting has a great influence on the final grade that he obtains. Selecting the California Psychological Inventory because it had been designed by Gough for normal individuals, Sister Breaux sought to identify non-academic factors related to academic achievement. Her investigation indicated that of the eighteen factors making up the California Psychological Inventory, the following were significantly related to academic achievement: Responsibility, Self-Control, Communality, Intellectual Efficiency, Sense of Well-Being, Social Presence, Socialization, Flexibility, Psychological-Mindedness, and Tolerance.

Although Cattell (1966) employed a different instrument to investigate the relationship between achievement and personality, the conclusion is of interest at this point. The results indicated that there were three types of predictors involved: intelligence, personality, and motivation. Each accounted for approximately one-third of the variance in the achievement score.

Several authors (Gough, 1957; Mitchell, Pierce, and Jones, 1960; Crites, Bechtoldt, Goodstrin, and Heilbrun, 1961; Nichols and Schnell, 1962; Springob and Struening, 1963; Crites, 1964) have carried out factor analysis studies of the California Psychological Inventory. The results of these factor analyses are found in Appendix A. Although varied means of analysis were conducted, in the main the studies generally supported Gough's first two groups; Group One - Measures Poise, Ascendancy, and

Self-Assurance; Group Two - Measure of Socialization, Maturity, and Responsibility. The remaining two groups; Group Three - Measure of Achievement Potential and Intellectual Efficiency, and Group Four - Measures of Intellectual and Interest Modes were poorly supported and this result led many of the investigators to question the need for these two groups. Crites (1961) and Springob (1963) questioned the need for eighteen factors, many of which they claimed overlapped. Each of these authors has advanced the opinion that a reliable measure of personality could be attained with this instrument, using a reduced set of factors (Appendix A). As this study did not attempt to determine an overall measure of personality, but rather a predictive pattern of individual variables, all eighteen factors were included.

Several authors have dealt with the topic of intelligence as a predictor variable in conjunction with interest and achievement tests. Barrelleaux (1961) administered both the Kuder Preference Record and the Otis Quick Scoring Mental Ability Tests to a sample of 802 high school graduates. Within the sample the I.Q. ranged from 86 to 139. A significant relationship was found to exist between the relative intensity of science interest and the probability of success in high school science. This relationship was found to be highest above the I.Q. level of 110.

To investigate the predictive relationship of intelligence for reading and arithmetic, Holowsky (1961) employed the Otis Quick Scoring Mental Ability Test, Beta and Gamma forms. The California Reading Tests form A.A. was employed as a reading measure, whereas, arithmetic was measured by the Wide Range Achievement Test. Within the population (ages ranged from twelve to seventeen years) highly significant correlations

between reading achievement and I.Q. were found at all age levels. General correlations ranged from .57 to .83 and the average correlation was .65.

Holowinsky (1961) indicated that the correlation between arithmetic and I.Q. seemed to be a function of age. It dropped from .59 at 12-13 years to .09 at 16-17 years, with the overall average correlation of .30. He also concluded that students of lower intellectual ability, regardless of age, tended to show higher achievement in arithmetic than in reading.

Keller and Rowley (1964) using the Otis Quick Scoring Mental Ability Test and Stanford Achievement Tests, reported a highly significant correlation between I.Q. and scholastic achievement. Frost (1965), in a study of conditions of scholastic achievement concluded: ", . . it is true that a reasonable amount of variance in scholastic achievement can be predicted from I.Q., but rarely more than fifty percent."

Such factors as environment and emotion should be considered when contemplating the consistency of intelligence as a predictor factor. It would seem, therefore, that prediction of achievement may be improved if a personality variable was considered in conjunction with an intelligence variable.

As a positive relationship has been suggested between intelligence and achievement, the Lorge-Thorndike Intelligence Test Level 4 A was included as a predictor variable. As this test established both a verbal and a non-verbal intelligence score, it was hoped that more discriminating prediction equations would be achieved than if an instrument yielding only a verbal score were employed.

Hypotheses

The review of the literature above demonstrates that the goal of matching students and teachers at the junior high school level by means of personality patterns within achievement level groups has been sought. However, to realize this goal it is first necessary to establish if regression systems which best predict a student's academic achievement can be identified. Secondly, it is necessary to establish if patterns of personality variables which would discriminate students within high, middle and low-achievement groups could be developed. The review of the literature would seem to indicate that personality variables have been employed successfully to predict academic achievement and to differentiate students within different academic groups. On this basis the following hypotheses were formulated.

Null Hypothesis One. There are no patterns of personality characteristics which can significantly improve the prediction of junior high school pupil's basic skill achievement which has been obtained from prediction systems using only the Lorge-Thorndike Intelligence Test scores.

Null Hypothesis Two, There are no patterns of personality characteristics which discriminate among groups of high-achievers, middle-achievers and low-achievers in the junior high school basic skills, when the achievement-level groups are defined in terms of expectations of achievement on the basis of their intelligence test scores and their scores on the subtests of the California Psychological Inventory,

A description of the students, the measurement instruments used, and a discussion of the rationale for the statistical analysis employed are contained in Chapter Three.

CHAPTER THREE

METHOD OF STUDY

This chapter contains a description of the students, the measurement instruments used, and a discussion of the rationale for the statistical analysis employed.

The Student Population

The students who were the subjects for this study were enrolled in a junior high school in Edmonton, Alberta. A single school was decided upon rather than several schools because of the limited budget under which this study was carried out. This particular school was employed because one of the members who participated in the study was employed as a teacher-counsellor within this school. The testing was carried out during the fall of 1968 by the teacher-counsellor. The scoring of all the tests was done by the Educational Research Services, University of Alberta, under the supervision of Dr. J. Bicknell.

The student population served by this school was drawn mainly from a middle socio-economic population. The fringes of the school boundaries are marked by low and high socio-economic populations. These students then, hopefully, represent a middle class urban junior high school population.

The total student population at the commencement of the study was 697 students. There were eight grade seven classes forming a population of 238; there were seven grade eight classes forming a

population of 183; and there were nine grade nine classes forming a population of 276.

All students from grades seven, eight and nine, who completed all tests were included in the analysis. Students who failed to complete all tests were dropped from the study population. Several students who transferred to other schools in the midst of the study were also dropped. These two factors tended to deplete the population, hence no attempt was made to differentiate students by sex or social class. Any differentiation other than grade would have described populations of so small a number that significant measurement and results would have been impossible.

A final population of 561 students was established and separated into two groups. Two-thirds of this population were randomly assigned to the "criterion sample" using a stratification by grades, while the remaining one-third comprised a cross-validation sample. The population was divided into a ratio of 2:1 for purposes of validation as it was decided that two-thirds of the population was needed to develop prediction equations and that one-third of the population was sufficient to provide cross-validation.

The number of students in each sample by grade is shown in Table 1.

TABLE 1
NUMBER OF STUDENTS BY SAMPLE AND BY GRADE

Grade	Criterion Sample	Cross Validation Sample	Total
7	124	62	186
8	93	49	142
9	148	76	224
Total	365	187	552

Slight variation in the ratio between samples at the grade eight and nine level and the final population total were accounted for by human error in preparing cards for the computer.

Description of Measures Used

Criterion Variable. The Canadian Test of Basic Skills (King, 1969) was designed to provide a measure of achievement in the basic skills thought to be essential to success in all types of school work. This test was employed with the hope that it would provide a standardized measure of achievement in the basic skill areas. Since subject marks were assigned independently by each teacher in each classroom within each grade, it was hoped that such a standardized measure would eliminate teacher biases. Scores on this test then, were an indirect assessment of the formal content of the junior high school curriculum.

The Canadian Test of Basic Skills was standardized on 30,000 Canadian pupils in the ten provinces and in 230 schools. Reliabilities,

established by split-half correlates computed by the Spearman-Brown formula, were based on a study of 12.5 percent of the standardization group. For grades six to eight, reliability coefficients ranged from .86 to .94 for the major area scores, and from .70 to .90 for the subtests within the major areas. The composite reliabilities for the whole test ranged from .96 to .97 for the three grades (King, 1968).

The test battery provided eleven scores:

1. Voc. (Vocabulary). The use of tools involved in word recognition, knowledge of the meaning of words, and the sensitivity to fine differences in meaning and judgment in choosing the most appropriate word in a given contextual situation.
2. R. Comp. (Reading Comprehension). The score orders students for their ability in the specific comprehension skills involved in grasping details and purpose, analyzing organization, and evaluating a reading selection.

Language Skills. This area of the test provides four sub-scores:

3. Spel. (Spelling).
4. Cap. (Capitalization).
5. Punc. (Punctuation).
6. Use. (Usage).

Work Study Skills. An area that attempts measurement in a skill area not taught formally as a subject in all elementary schools. The tests are designed to evaluate the child's ability in:

7. Map. (Map Reading).
8. R.G.T. (Reading Graphs and Tables).

9. Ref. (Knowledge and Use of Reference Tables).

Mathematics Skills. The emphasis in this area is on understanding number systems, terms, processes and operations, geometric concepts, and units of measurement. The two sub-scores in this area are:

10. Con. (Mathematical Concepts).

11. Prob. (Mathematical Problem Solving).

Predictor Variables. In Chapter II, page 10, the rationale for the use of the California Psychological Inventory was explained and studies relating its predictive value were cited. The eighteen scales of the California Psychological Inventory, were employed as a set of predictor variables. In every case, a high positive score for a specific scale indicated an expression of that trait in the individual's personality profile. An expression of the direct opposite of the measured trait was indicated by a high negative score for a specific scale. The scales are as follows (Gough, 1964):

1. Fx. (Flexibility). To indicate the degree of flexibility and adaptability of a person's thinking and social behavior.
2. Gi. (Good Impression). To identify persons capable of creating a favorable impression and who are concerned about how others react to them.
3. Wb. (Sense of Well-Being). To identify persons who minimize their worries and complaints, and who are relatively free from self-doubt and disillusionment.
4. Re. (Responsibility). To identify persons of conscientious,

responsible, and dependable disposition and temperament.

5. Sy. (Sociability). To identify persons of outgoing, sociable, participative temperament.
6. Fe. (Femininity). To assess the masculinity or femininity of interests. (High scores indicate more feminine interests, low scores more masculine.)
7. Sp. (Social Presence). To assess factors such as poise, spontaneity, self-confidence in personal and social interaction.
8. Do. (Dominance). To assess factors of leadership ability, dominance, persistence and social initiative.
9. Cs. (Capacity for Status). To serve as an index of an individual's capacity for status (not his actual or achieved status). The scale attempts to measure the personal qualities and attributes which underlie and lead to status.
10. Cm. (Communality). To indicate the degree to which an individual's reactions and responses correspond to the modal ("common") pattern established for the inventory.
11. Py. (Psychological-Mindedness). To measure the degree to which the individual is interested in, and responsive to, the inner needs, motives and experiences of others.
12. Sa. (Self-Acceptance). To assess factors such as sense of personal worth, self-acceptance, and capacity for independent thinking and action.
13. Ac. (Achievement via Conformance). To identify those factors of interest and motivation which facilitate achievement in any setting where conformance is a positive behavior.

14. To. (Tolerance). To identify persons with permissive, accepting, and non-judgmental social beliefs and attitudes.
15. So. (Socialization). To indicate the degree of social maturity, integrity, and rectitude which the individual has attained.
16. Ie. (Intellectual Efficiency). To indicate the degree of personal and intellectual efficiency which the individual has attained.
17. Ai. (Achievement via Independence). To identify those factors of interest and motivation which facilitate achievement in any setting where autonomy and independence are positive behaviors.
18. Sc. (Self-Control). To assess the degree and adequacy of self-regulation and self-control and freedom from impulsivity and self-centeredness.

In Chapter II, reference was made to the major portion of the variance in achievement which is attributable to intelligence. Therefore, a measurement of intellectual ability, the Lorge-Thorndike Intelligence Test Level 4 A, was included as a predictor variable. This particular test was employed because it was part of the standard testing program of the Edmonton Public School System. The test scores are deviation I.Q.'s with a mean of 100 and a standard deviation of 16. The Lorge-Thorndike provides two distinct measures: a verbal I.Q. and a non-verbal I.Q.

Reliability of the Lorge-Thorndike tests has been achieved mainly through alternate forms of the test, and odd-even correlations. Alternate forms indicate correlations of .87 for the verbal area and .78 for the non-verbal area. Odd-even comparisons provide correlations of .93 for both verbal and non-verbal areas. Validity measures, when

the Lorge-Thorndike has been employed as a predictor vehicle, have been formed through comparisons with achievement tests. At the grade four level, Lorge-Thorndike when compared to the Iowa Test of Basic Skills, indicates correlations of .73 to .84 for the verbal area and .58 to .69 for the non-verbal area. When compared with the Stanford Intermediate Reading and Arithmetic Tests correlations of .87 and .76 for the verbal area, were obtained respectively at the grade six level. At the grade five level, correlations of .71 and .75 were obtained from a comparison between the Lorge-Thorndike and the Stanford Elementary Reading and Arithmetic Tests respectively. Finally comparison of the Lorge-Thorndike and the California Achievement Tests at the grade eight level for total achievement provided a verbal correlation of .88 and a non-verbal correlation of .72.

Thus, eighteen personality variables and two intellectual variables were selected to predict the performance of junior high school students in eleven achievement variables for each of the three grade levels.

Statistical Procedures

This study was initiated to assess the relationship between the academic performances of junior high school pupils and certain selected personality traits which they possessed. To determine if in fact relationships did exist, it was proposed that a correlation matrix, be completed between all variables. If stable relationships were found, then it was the purpose of the study to develop equations for the prediction of academic performance based upon these relationships.

The practical significance of using personality traits to group

pupils posed a problem. To evaluate this, it was decided to employ only those personality trait scores which added significantly to the total accountable variance. For this purpose it was decided to employ a 31 by 31 correlation matrix using a step-wise multiple regression analysis for each of the three grades.

In this procedure a coefficient of correlation was calculated between each of the eighteen personality trait scores, the two intelligence test scores, and each of the eleven basic skills test scores. A step-wise regression was carried out in which each of the eleven basic skills test scores was predicted using the personality trait scores as predictors. The predictors were added to the individual regression equations according to the magnitude of their correlation with the basic skill being predicted. The predictor variable having the highest correlation with the basic skill was the first to be added, followed by the predictor variable exhibiting the second highest correlation, then the third highest, until all predictor variables had been employed. As each predictor variable was added its contribution to the overall prediction was calculated by comparing the regression sum of squares yielded by the new regression equation with that yielded by the immediately preceding regression equation. A predictor variable was considered to be significantly related to a basic skill, if it contributed to the regression sum of squares at the .05 level of probability as determined by a F-test, and/or if it contributed an increase of at least one percent to the sum of squares for regression. It was thus possible to determine the personality traits which were significantly related to the

various basic academic skills.

Final regression equations were derived employing the significant predictor variables. These equations were then applied to the data comprising the cross-validation sample to obtain predicted basic skills scores for each student by grade. The predicted scores were then correlated with the corresponding actual scores. Correlations then obtained were compared with coefficients of the multiple correlations from the original sample to test the validity of the regression equations.

The most widely used and accepted predictors of academic performance are intelligence scores. One of the aims of this research study was to examine the effectiveness of adding psychological variables to the intelligence score predictors. To evaluate the predictive improvement attained in the regression equations by the inclusion of the personality trait scores, a regression analysis was completed employing only the Lorge-Thorndike scores as predictors of the basic skills. A comparison was then made between the squared multiple correlations obtained between the regression equations containing personality trait scores and those containing only the Lorge-Thorndike scores.

The second purpose of the study was to determine whether there were patterns of personality traits which differentiated in prediction equations for different levels of achievement by grade.

Achievement is employed here as a means of measuring the difference between the actual and the expected basic skill scores. Hence the low-achievers would be a group of students whose actual basic skill

scores are well below their expected basic skill scores. The middle-achievers would be a group of students whose actual and expected basic skill scores were almost identical. The high achievers would be a group of students whose actual basic skill scores greatly surpassed their expected basic skill scores.

It was possible, by employing the actual and predicted grade for each student, to compute the standard error of estimate. The predicted grade for each student was derived from the regression equations employing the two Lorge-Thorndike variables and the personality variables. The standard error of estimate was then used to divide each grade population into three groups; low-achievers, middle-achievers, and high-achievers. Low-achievers were those students who achieved beyond minus one standard error of estimate of their expected achievement-level on one of the basic skill sub-tests. Middle-achievers were those students who achieved between plus or minus one standard error of estimate of their expected level on one of the basic skill sub-tests. High-achievers were those students who achieved beyond plus one standard error of estimate of their expected achievement level on one of the basic skill sub-tests.

A three-group multiple discriminant analysis was carried out on the three achievement-level groups, using the eighteen sub-scales of the California Psychological Inventory. The maximum number of discriminant vectors which could be obtained in a three-group analysis was two. To determine the effectiveness of discrimination among the three groups, each discriminant function was tested for significance. For each significant discriminant function the discriminant vectors were identified in

terms of the highest loading variables. Then each of the three groups, by grade, was described in terms of its position in the two-dimensional space defined by the discriminant vectors. In this manner it was possible to describe the configuration of personality traits by which each achievement-level group could be differentiated from each of the remaining two groups.

The discriminant analysis which has been described above was carried out for each of the eleven basic skills in each of the three grade level groups. The results of the discriminant analysis as well as those of the step-wise regression analysis and the cross-validation analysis are summarized in Chapter IV.

CHAPTER FOUR

RESULTS OF ANALYSES

This chapter contains the results of the multiple step-wise regression analysis, the regression equation systems, the cross-validation analysis, and the discriminant analysis.

Multiple Step-Wise Regression Analysis

As was described in the preceding chapter a multiple step-wise regression analysis was carried out with the criterion sample to determine the combination of predictor variables that would be most effective in predicting each of the eleven basic skills. The predictor variables in this analysis were the intelligence test scores combined with the sub-test scores from the personality inventory.

The correlation coefficient between each predictor variable and each of the basic skills is shown for each of the grades seven, eight and nine in Tables 2, 3, and 4, respectively. As expected, with three exceptions, the highest correlations were obtained between the verbal scores on the Lorge-Thorndike Intelligence Test and the basic skills scores. The verbal intelligence scores were therefore always first to enter the step-wise regression analysis. In comparing the correlations between verbal intelligence and the basic skills obtained for the three grades, two phenomena were observed.

From grade seven through grade nine the correlation between verbal intelligence and basic skill achievement tended to become lower. The median of the correlations between the verbal intelligence and the

TABLE 2

CORRELATION COEFFICIENTS OF THE TWENTY PREDICTOR VARIABLES
WITH EACH OF THE ELEVEN CRITERION SCORES - GRADE SEVEN

Crit.	Predictor		Fx	Gi	Wb	Re	Sy	Fe	Sp	Do	Cs	Cm	Py	Sa	Ac	To	So	Ie	Ai	Sc
	Verb	N- Verb																		
Voc	.61	.45	.19	-.14	.37	.21	.21	-.09	.16	.08	.04	.50	-.05	.29	.28	.24	.34	.27	.24	.05
R.C.	.73	.55	.29	-.10	.37	.31	.30	-.07	.20	.13	.18	.49	-.07	.29	.22	.32	.40	.48	.31	.04
Spel	.59	.34	.15	-.04	.24	.20	.24	-.02	.13	.10	.01	.30	-.10	.20	.20	.25	.26	.25	.22	.06
Cap	.55	.38	.16	-.21	.27	.11	.28	-.10	.25	.00	.03	.44	-.25	.22	.04	.13	.21	.27	.15	-.07
Punc	.63	.45	.16	-.13	.36	.27	.31	-.01	.28	.16	.18	.44	-.14	.24	.26	.27	.29	.36	.26	.04
Use	.65	.56	.10	-.15	.37	.21	.35	-.08	.26	.10	.12	.58	-.14	.28	.25	.21	.46	.45	.22	-.05
Map	.60	.53	.06	-.13	.24	.25	.30	-.15	.20	.07	.20	.43	-.10	.23	.16	.14	.30	.30	.20	-.06
R.G.T.	.63	.52	.09	-.19	.29	.18	.21	-.22	.20	.05	.06	.47	-.19	.24	.13	.22	.36	.30	.19	-.12
Ref	.71	.55	.17	-.12	.46	.30	.37	-.12	.31	.09	.16	.57	-.10	.30	.32	.30	.44	.51	.29	.00
Con	.70	.55	.11	-.16	.39	.19	.29	-.21	.32	.03	.11	.52	-.11	.25	.16	.21	.42	.39	.16	-.00
Prob	.54	.50	.13	-.19	.32	.18	.24	-.17	.17	.05	.10	.49	-.17	.17	.17	.16	.36	.38	.12	-.05

TABLE 3

CORRELATION COEFFICIENTS OF THE TWENTY PREDICTOR VARIABLES
WITH EACH OF THE ELEVEN CRITERION SCORES - GRADE EIGHT

Predictor																				
Crit	Verb	N- Verb	Fx	Gi	Wb	Re	Sy	Fe	Sp	Do	Cs	Cm	Py	Sa	Ac	To	So	Ie	Ai	Sc
Voc	.63	.46	-.10	-.01	.25	.42	.10	.32	-.06	.15	.10	.34	.12	.14	.16	.23	.30	.29	.21	.14
R.Comp	.64	.59	.07	-.13	.40	.50	.16	.34	.10	.17	.13	.52	.07	.16	.23	.34	.45	.40	.22	.09
Spel	.58	.44	.01	-.12	.27	.36	.11	.45	.15	.14	.15	.35	.09	.18	.24	.21	.36	.35	.20	.03
Cap	.40	.43	.11	-.13	.36	.34	.18	.37	.19	.21	.26	.42	.02	.27	.25	.30	.39	.42	.26	.04
Punc	.49	.54	.06	-.14	.37	.41	.07	.41	.10	.14	.16	.44	.10	.11	.31	.35	.49	.40	.29	.14
Use	.64	.58	.09	-.07	.48	.49	.18	.40	.20	.19	.28	.45	.16	.16	.35	.45	.46	.51	.29	.21
Map	.59	.53	-.05	-.21	.08	.36	.12	.10	.06	.08	.04	.28	.04	.19	.03	.09	.19	.23	.35	.06
R.G.T.	.57	.49	.12	-.12	.21	.40	.21	.23	.11	.19	.14	.33	.10	.24	.15	.21	.27	.35	.22	.05
Ref	.63	.58	.04	-.14	.36	.50	.24	.50	.14	.22	.17	.40	.07	.22	.26	.33	.46	.44	.26	.04
Con	.52	.61	-.01	-.21	.17	.35	.20	.15	.04	.28	.15	.28	.04	.27	.06	.15	.20	.25	.21	-.17
Prob	.45	.48	.04	-.11	.17	.31	.00	.22	-.01	.05	.05	.25	.03	.07	-.03	.18	.22	.31	.11	.04

TABLE 4

CORRELATION COEFFICIENTS OF THE TWENTY PREDICTOR VARIABLES
WITH EACH OF THE ELEVEN CRITERION SCORES - GRADE NINE

Crit	Predictor		Fx	Gi	Wb	Re	Sy	Fe	Sp	Do	Cs	Cm	Py	Sa	Ac	To	So	Ie	Ac	Sc
	Verb	N- Verb																		
Voc	.66	.42	-.05	-.03	.22	.29	.15	.01	.14	.24	.33	.22	.10	.20	.22	.32	.21	.44	.35	.10
R.Comp	.70	.47	-.02	-.11	.23	.31	.21	.10	.15	.24	.30	.45	-.03	.24	.19	.28	.26	.46	.28	-.05
Spel	.51	.33	-.11	-.11	.14	.19	.08	.22	.06	.14	.15	.31	.02	.11	.03	.17	.17	.16	.19	.01
Cap	.35	.44	-.08	-.05	.23	.22	.21	.13	.14	.18	.24	.30	.10	.15	.14	.19	.26	.34	.23	.10
Punc	.50	.47	-.03	-.05	.24	.32	.18	.17	.11	.19	.20	.27	-.01	.22	.15	.23	.20	.32	.29	.04
Use	.43	.42	-.02	-.01	.20	.27	.11	.32	.05	.18	.20	.22	-.02	.10	.14	.26	.23	.26	.20	.12
Map	.44	.49	-.03	-.00	.12	.20	.24	-.17	.23	.15	.27	.16	.13	.11	.17	.15	.13	.35	.24	-.04
R.G.T.	.37	.46	-.03	-.05	.18	.10	.19	-.05	.18	.17	.11	.13	.11	.06	.13	.12	.06	.30	.18	.03
Ref	.58	.51	-.04	-.07	.07	.23	.17	.18	.11	.15	.25	.16	.03	.11	.09	.14	.14	.28	.23	-.07
Con	.47	.42	-.04	-.09	.16	.23	.29	-.04	.20	.16	.30	.14	.12	.15	.14	.18	.11	.32	.20	.01
Prob	.33	.37	-.06	-.03	.08	-.01	.15	-.02	.14	.08	.04	.03	.01	.03	-.04	.01	.03	.19	-.03	-.14

basic skills achievement declined through grades seven to nine from .63 to .58 to .49 respectively as shown in Tables 2, 3, and 4. The range of these correlations remained at a constant .19 for grades seven and eight, but increased sharply to .37 for grade nine. Throughout the three grades the lowest correlation was consistently between verbal intelligence and Mathematical Problem Solving; while the highest correlation was consistently that between verbal intelligence and Reading Comprehension.

It would seem therefore that either the intelligence scores have become less satisfactory as predictors of achievement at the grade nine level or the basic skills tests have failed to identify achievement at this grade level. It may be noted here that although the Iowa Test of Basic Skills, upon which the Canadian test was modelled, was designed to test achievement from grades three to nine, the Canadian test was only designed to test achievement from grades three to eight. Therefore the grade nine sample performed the same basic skill tasks as did the grade eight sample.

An examination of the means for the basic skills for each of the three grades indicates that the highest scores were achieved in grade nine. Seven of the basic skills score means indicated progressively larger scores through the grades from seven to nine. Only two means, those for Vocabulary and Reading Comprehension, at the grade nine level indicated excessive increases in mean scores. The mean scores for the basic skill tasks of Reading Graphs and Tables, Knowledge and Use of Reference Tables, and Mathematical Concepts attained the highest level

for the grade nine sample, but these scores at the grade eight level were lower than they were for the grade seven sample. The mean score for the basic skill task Language Skill Usage was the same for grades seven and nine samples, but declined slightly for the grade eight sample.

It would generally appear that the Canadian Test of Basic Skills adequately measured academic achievement throughout the three junior high school grades. The inclusion in the predictor equations of personality factors in addition to intelligence test scores to improve the prediction of academic performance thus appears a tenable hypothesis.

Predictor variables were added to the systems for the prediction of each of the basic skills in the order of the magnitude of their correlations with the basic skills to be predicted. Inter-correlations between predictor variables became a significant factor. The addition of the most significant of two related factors had a tendency to reduce the amount of the variance contributed by the second factor. In some cases the apparent order, based on the correlations reported in Tables 2-4, of the predictor variables was changed completely so that a factor which taken alone correlated highly with the criterion variable, did not appear in the regression equation at all. The inter-correlations between predictor variables determined the loading order rather than the magnitude of the correlation between the individual predictor variable and the specific criterion variable.

The contribution to the total variance by each added variable was tested for significance according to the criteria set down on page 25. Regression systems were selected which contained only those variables which met these criteria. A multiple regression analysis was

TABLE 5

REGRESSION EQUATIONS FOR THE PREDICTION OF GRADE SEVEN BASIC SKILLS

Voc.	=	- .54	Ie + .48	Cm + .47	Verb + .37	Ai + .32	Wb + .22	Sa	-11.13
R.Comp.	=	.67	Verb + .62	Fx + .38	Ie + .22	N-V + .19	Wb	-28.94	
Spel.	=	.45	Verb + .17	Do	-4.48				
Cap.	=	-.47	Py + .35	Cm	-.32	So + .30	Verb + .25	Wb + 6.24	
Punc.	=	-.36	Py + .34	Wb + .33	Verb + .28	Do	-.23	So + .08	N-V -4.92
Use.	=	.28	Cm + .19	Verb + .13	Ie + .10	N-V	-6.07		
Map.	=	.21	Verb + .21	Cs + .12	N-V + .12	Cm + .02	Re	-6.36	
R.G.T.	=	-.23	Fe + .19	Cm + .15	Verb	-.09	Cs + .08	Do + .08	N-V -.04 Sc + 2.56
Ref.	=	.44	Verb + .40	Wb + .30	Ie	-.21	Sc + .13	N-V	-14.90
Con.	=	.28	Verb + .26	Cm	-.25	Fe	-.23	Ac + .23	Wb + .15 Sp + .13 N-V -6.77
Prob.	=	.28	Cm	-.21	Fe + .16	Fx + .10	N-V + .07	Verb + 0.45	

TABLE 6

REGRESSION EQUATIONS FOR THE PREDICTION OF GRADE EIGHT BASIC SKILLS

Voc.	=	-.59 Fx	-.44 Ac + .43 Verb + .38 Fe + .37 Py + .27 Wb	-2.86
R.Comp.	=	.59 Verb + .43 Cm + .37 Wb	-.31 Gi + .17 N-V	-13.22
Spel.	=	.79 Fe + .48 Verb + .41 Sp	-.39 Sy	-.31 Sc + .18 Wb
Cap.	=	.33 Fe + .28 Ie	-.27 Gi + .10 N-V + 2.18	-19.47
Punc.	=	.31 Fe + .26 So + .25 N-V	-.15 Gi	-.12 Fe + .10 Verb
Use.	=	.25 Wb + .20 Verb + .16 Fe	-.14 Gi	-.11 Sa + .11 N-V
Map.	=	-.38 To + .36 Ai + .24 Re + .20 Verb	-.15 Fe	-.14 Gi + .08 N-V + 0.36
R.G.T.	=	.23 Fx + .16 Verb	-.13 To + .10 Sy + .09 N-V + .08 Ie	-4.81
Ref.	=	.73 Fe + .37 Verb	-.31 Sc + .31 Wb + .20 N-V	-.17 Gi
Con.	=	-.36 Sc + .26 Do + .25 N-V	-.22 Sp + .18 Verb + .16 Wb + 0.65	
Prob.	=	-.42 Ac + .29 Ie + .21 Fe	-.19 Fx + .13 N-V + .05 Verb + 0.77	

TABLE 7

REGRESSION EQUATIONS FOR THE PREDICTION OF GRADE NINE BASIC SKILLS

Voc.	=	.51	Ie	+	.47	Verb	-	.31	Gi	+	.29	Sc	-	.28	Fx	-	.24	Ac	-	9.68						
R.Comp.	=	.89	Cm	+	.72	Verb	+	.70	Ie	-	.36	Ac	-	.30	Gi	-	25.16									
Spel.	=	-.60	Fx	-	.60	Ac	+	.52	Verb	+	.43	Cm	+	.41	Ai	+	.34	Wb	+	.28	Fe	-	.19	Ie	+	9.45
Cap.	=	-.26	Gi	+	.26	Ie	+	.25	Verb	+	.16	So	+	0.50												
Punc.	=	-.27	Gi	+	.24	Verb	+	.24	Wb	+	.22	N-V	+	.17	Fe	+	.16	Re	+	.07	Ai	-	14.03			
Use.	=	.26	Fe	+	.16	N-V	+	.15	Verb	-	5.41															
Map.	=	.21	N-V	-	.19	Sa	+	.17	Sy	-	.16	Fe	+	.16	Verb	+	.08	Ie	+	1.04						
R.G.T.	=	-.17	Sa	+	.13	N-V	-	.13	To	+	.12	Ie	+	.11	Sy	+	.07	Verb	+	2.99						
Ref.	=	.60	Cs	+	.46	Verb	-	.35	To	+	.35	Fe	+	.35	N-V	-	.20	Sa	-	20.06						
Con.	=	.44	Sy	+	.30	Verb	+	.23	N-V	-	.21	Do	-	12.27												
Prob.	=	-.23	Ai	-	.18	Ac	+	.17	Ie	+	.16	N-V	+	.12	Verb	+	.08	Sy	-	1.17						

then performed so that regression weights could be calculated for these systems. The eleven regression equations thus obtained for each grade are shown in Tables 5, 6, and 7, respectively.

To test the validity of these thirty-three regression equations a cross-validation analysis was performed. The regression equations were used to predict the corresponding basic skill scores for each pupil in the cross-validation sample. Pearson's product moment correlations were used to predict the corresponding basic skill scores for each pupil in the cross-validation sample. Pearson's product moment correlations were calculated between the actual and predicted scores. These correlations were then compared to the multiple correlations obtained from the regression equations obtained on the criterion student sample. The comparison of these correlations is shown in Table 8.

Throughout the eleven criterion variables the agreement between the two correlations was extremely close for grades seven and eight. For grade nine however, this was not the case. Agreement between the two correlations was acceptable in most cases but became very weak in the Work Study Skills and Mathematical Problem Solving Skill.

It was not sufficient to state only that personality variables could improve prediction of basic skills when they were added to intelligence variables. It was also necessary to evaluate the amount to which they contributed in the prediction of these basic skills. To measure this contribution a comparison of squared multiple correlations (R^2) was completed between equations containing both intelligence and personality variables, and those containing only intelligence variables.

TABLE 8
RESULTS OF CROSS VALIDATION ANALYSIS BETWEEN
CRITERION SAMPLE AND CROSS VALIDATION SAMPLE

Criterion Variable	Grade 7		Grade 8		Grade 9	
	Criterion	Cross Val	Criterion	Cross Val	Criterion	Cross Val
	R N 124	R N 62	R N 93	R N 49	R N 148	R N 76
Voc.	.67	.64	.70	.62	.74	.74
R. Comp.	.77	.79	.74	.74	.81	.70
Spel.	.56	.64	.72	.56	.64	.56
Cap.	.61	.58	.59	.58	.54	.33
Punc.	.69	.55	.70	.59	.64	.63
Use.	.73	.71	.78	.69	.60	.54
Map.	.64	.49	.69	.63	.62	.46
R.G.T.	.70	.64	.64	.54	.56	.47
Ref.	.78	.70	.79	.66	.70	.32**
Con.	.78	.58	.72	.52	.58	.57
Prob.	.65	.61	.62	.58	.49	.20*

**Denotes shrinkage at the .01 level of significance.

*Denotes shrinkage at the .05 level of significance.

TABLE 9

COMPARISON OF SQUARED MULTIPLE CORRELATIONS OBTAINED FROM REGRESSION EQUATIONS
WITH AND WITHOUT PERSONALITY CHARACTERISTICS SCORES BY GRADE LEVEL AND BASIC SKILL

Basic Skill	Grade Seven		Variance Improvement	Grade Eight		Grade Nine			
	R ² Large Thorndike Only	R ² Large Thorndike & Personality		R ² L-T Only	R ² L-T & P	R ² L-T Only	R ² L-T & P	V.I.	
Voc.	.38	.45	.07	.40	.49	.09	.46	.47	.01
R.Comp.	.54	.60	.06	.44	.55	.11	.52	.65	.13
Spel.	.31	.32	.01	.35	.52	.17	.28	.41	.13
Cap.	.30	.40	.10	.21	.35	.14	.22	.29	.07
Punc.	.40	.48	.08	.32	.49	.17	.33	.41	.08
Use.	.46	.53	.07	.45	.61	.16	.25	.35	.10
Map.	.39	.41	.02	.38	.47	.09	.30	.38	.08
R.G.T.	.42	.49	.07	.35	.41	.06	.25	.31	.06
Ref.	.52	.60	.08	.44	.53	.09	.42	.49	.07
Con.	.51	.60	.09	.40	.51	.11	.28	.34	.06
Prob.	.34	.42	.08	.26	.39	.13	.17	.24	.07

R^2 denotes the percentage of the variance on the criterion that is predicted by the regression equation. The percentage improvement shown by this comparison is shown in Table 9. The squared multiple correlation for Vocabulary obtained by Lorge-Thorndike variables only is shown in Table 9 as being .38, while with the inclusion of both Lorge-Thorndike variables and personality variables the squared multiple correlation is .45. The latter regression accounted for seven percent more of the variance than could be accounted for by intelligence test scores alone.

The regression equations thus developed for each grade and for each criterion variable provide a means of constructing a characteristic prediction profile of the students within each grade. Several of the personality variables occurred repeatedly in the regression equations for each grade. An examination of the regression equations indicated that several of the personality variables had a high frequency of occurrence while others had a lower frequency of occurrence. The frequency of expression for each personality variable in the regression equations is shown in Table 10.

At the grade seven level the personality factors with the most frequent occurrence in adding to the predictability of the eleven tasks were: Communalilty (6), Sense of Well-Being (6), and Intellectual Efficiency (4). The grade seven Profile then weighed heavily with such characteristics as:

1. Cm. (Communalilty): dependable, sincere, honest, and conscientious,
2. Wb. (Sense of Well-Being): energetic, versatile,

TABLE 10

FREQUENCY OF PREDICTOR VARIABLES EXPRESSED IN EACH GRADE FOR EACH BASIC SKILL AREA

Grade Variable	Voc.			R.Comp			Spel.			Cap.			Punc.			Use.			Map.			R.G.T.			Ref.			Con.			Prob.			Total 33
	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9	7	8	9				
V	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	31			
NV																															25			
Fx																															7			
Gi																															10			
Wb																															14			
Re																															4			
Sy																															6			
Fe																															16			
Sp																															3			
Do																															5			
Cs																															3			
Cm																															10			
Py																															2			
Sa																															5			
Ac																															7			
To																															4			
So																															3			
Ie																															13			
Al																															5			
Sc																															7			
Total	6	6	6	5	5	4	2	6	8	5	4	4	5	6	7	4	6	3	5	7	6	7	6	6	5	6	6	7	6	4	5	6	6	

productive and value work and effort for its own sake.

3. Ie. (Intellectual Efficiency): cautious, defensive, and somewhat stereotyped in thinking.

Those personality factors of lesser frequency at the grade seven level were Dominance (2) and Femininity (2). These two variables added such characteristics as:

4. Do. (Dominance): aggressive, persistent, persuasive, and independent.
5. Fe. (Femininity): outgoing, ambitious, active, opportunistic in dealing with others, blunt and direct in thinking, and impatient with delay.

Good Impression did not contribute significantly to the predictions at the grade seven level, even though its first order correlation with the basic skills was consistently negative (Table 2),

The grade eight student criterion sample was identified most frequently with such variables as Femininity (7), Sense of Well-Being (6), and Good Impression (6). Characteristics important to the grade eight predictions were:

1. Fe. (Femininity): appreciative, patient, moderate, persevering, and sincere, respectful and accepting of others, conscientious and sympathetic.
2. Wb. (Sense of Well-Being): energetic, enterprising, ambitious, productive and valuing work for its own sake.
3. Gi. (Good Impression): cautious, wary, cool in relationships with others, self-centered, and little concern for needs of others.

Variables of lesser frequency were Flexibility (3), Intellectual Efficiency (3), and Self-Control (3). These variables added to the predictions such characteristics as:

4. Fx. (Flexibility): insightful, adventurous, humorous, idealistic, sarcastic and cynical, high concern for personal pleasure.
5. Ie. (Intellectual Efficiency): efficient, capable, progressive, resourceful, high value on cognitive values.
6. Sc. (Self-Control): calm, thoughtful and deliberate, strict and thorough in their own work, honest and conscientious.

The grade nine student criterion sample presented a somewhat more complex situation as several of the personality variables attained significance in adding to the prediction equations. Intellectual Efficiency (6) became the most frequent factor, followed closely by Femininity (5), Good Impression (4), Achievement via Conformance (4), and Sociability (4). The grade nine predictions weighed heavily with such characteristics as:

1. Ie. (Intellectual Efficiency): efficient, intelligent, resourceful, alert, and well informed.
2. Fe. (Femininity): appreciative, patient, persevering, and sincere, conscientious, and sympathetic.
3. Gi. (Good Impression): cautious, shrewd, wary, cool and distant in relationships with others, self-centered.
4. Ac. (Achievement via Conformance): coarse, insecure and opinionated, aloof, easily disorganized under pressure to conform.
5. Sy. (Sociability): outgoing, enterprising, ingenious, competitive, and fluent in thought.

Variables of lesser frequency that contributed to the grade nine predictions were Achievement via Independence (3) and Self-Acceptance (3). Characteristics descriptive of these two variables were:

6. Ai. (Achievement via Independence): mature, forceful, dominant, self-reliant, and superior judgement.
7. Sa. (Self-Acceptance): methodical, conservative, dependable, conventional, and given to feelings of guilt and self-blame.

Throughout the three grades, the only consistent predictor variables were Intellectual Efficiency and Femininity. Intellectual Efficiency was a more influential predictor in grades seven and nine than it was in grade eight. Femininity exerted its greatest influence in grades eight and nine.

With the exception of the variables Intellectual Efficiency and Femininity, none of the remaining predictor variables had a consistent influence across the three grade criterion samples. Many of the influencing variables expressed in the grade seven predictions were not expressed in the grade nine predictions and many of the variables expressed in the grade nine predictions were not to be found in the grade seven predictions. However, variables representative of prediction in the grade eight population were expressed as predictors in either the grade seven criterion sample or the grade nine criterion sample.

It would seem that the grade eight criterion sample represents a year of transition. Many of the significant variables in the grade seven predictions have phased out in the grade eight predictions, while others appeared and became quite significant for the grade nine predictions.

Inspection of Table 10 indicated:

1. Wb. (Sense of Well-Being): was important in grade seven but phased out in grade eight.
2. Cm. (Communality): was important in grade seven but made no appearance in grade eight or nine.
3. Fe. (Femininity): was of slight importance in grade seven, of major importance in grade eight, but dropped again in grade nine.
4. Ac. (Achievement via Conformance): made no showing in grade seven, but appeared in grade eight and became stronger in grade nine.

5. Sc. (Self-Control): expressed slightly in grade seven, gained strength in grade eight but was not expressed in the grade nine population.
6. Ie. (Intellectual Efficiency): was expressed slightly in grade seven and eight, but was a major factor for the grade nine predictions.
7. Ai. (Achievement via Independence): made no significant contribution in either grade seven or eight but began to show strength in the grade nine sample.

Although all three grade criterion samples, seven, eight, and nine, were located within the same academic institution, there seemed to be several and distinct differences in the personality variables associated with the prediction of the criterion variables.

Discriminant Analysis by Achievement Levels

A three group discriminant analysis was carried out for each basic skill at each grade level to determine whether it was possible to characterize the pupils by personality variables in each of the three achievement-level groups: low-achievers, middle-achievers, and high-achievers. The independent variables used in the discriminant functions were the eighteen sub-scale scores from the California Psychological Inventory.

Determination of Achievement Level Groups. For these analyses it was necessary to classify the pupils into three achievement-level groups. The criterion sample and cross-validation samples were combined to form the student population. The regression equations which utilized both the Lorge-Thorndike test scores and the personality variables as independent variables were applied to each pupil to obtain an expected basic skill score. The achievement level for each pupil was determined

using the formula:

$$Z_y = \frac{Y_o - Y_e}{SE (est)}$$

Where: Y_o = the actual score on the basic skill obtained by the pupil.

Y_e = the expected score on the basic skill predicted for the pupil.

$SE (est)$ = the standard error of estimate for the regression equation.

Group I Low-Achievers. This group was defined as those students whose expected basic skill scores exceeded their actual score by more than one standard error of estimate, ie. those students whose Z_y scores were negative and less than -1.00.

Group II Middle-Achievers. This group was defined as those students whose actual basic skill scores were within one standard error of estimate of their expected scores, ie. those students for whom $-1.00 \leq Z_y \leq 1.00$.

Group III High-Achievers. This group was defined as those students whose actual basic skill scores exceeded their expected scores by more than one standard error of estimate, ie. those students whose Z_y scores were positive and greater than 1.00.

A predicted score for each basic skill was calculated for each student in each grade. The standard error of estimate was calculated for each basic skill by grade and the procedure of placing students within the three achievement-levels was carried out. With three achievement groups it was only possible to derive two discriminant vectors for each of the thirty-three discriminant analyses. Of the thirty-three

TABLE 11

SUMMARY OF DISCRIMINANT ANALYSIS OF LOW, MIDDLE,
AND HIGH ACHIEVEMENT BY GRADE AND BY BASIC SKILLS

Basic Skills	"F" Values by Grades					
	F	7 Prob.	F	8 Prob.	F	9 Prob.
Voc.	1.16	.25	1.28	.13	1.44	.05*
R. Comp.	1.09	.33	1.49	.04*	1.19	.21
Spel.	.79	.80	.82	.75	1.12	.30
Cap.	.95	.56	.77	.83	.80	.79
Punc.	.91	.61	.72	.88	.79	.80
Use.	1.25	.16	1.29	.13	1.16	.25
Map.	1.21	.19	.86	.72	1.10	.32
R.G.T.	1.37	.08*	1.49	.04*	1.14	.26
Ref.	1.04	.42	1.15	.26	.90	.64
Con.	.99	.49	.72	.88	.90	.63
Prob.	1.21	.19	.96	.55	.95	.55

*Significant at the .10 level.

discriminant analyses, only four yielded F-values which exceeded that required at .10 level of confidence. The F-values and their probabilities are shown in Table 11. At the grade seven level, Reading Graphs and Tables reached significance, while at the grade eight level both Reading Comprehension and Reading Graphs and Tables obtained significance. At the grade nine level only Vocabulary reached the level of significance. The number of students in each achievement-level group for these four basic skill areas is presented in Table 12.

TABLE 12
POPULATION OF ACHIEVEMENT LEVEL GROUPS BY GRADE FOR
THE SIGNIFICANT BASIC SKILL AREAS

Grade	Basic Skill	Achievement Level Group		
		Low	Middle	High
7	R.G.T.	36	122	28
8	R.Comp	30	134	33
8	R.G.T.	28	133	35
9	Voc.	34	161	29

Results of the discriminant analysis are provided for the basic skill areas that attained significance. A complete description of the procedure is provided with the results of the grade eight Reading Graphs and Tables basic skills area. Tables providing the results of the three remaining basic skills are located in Appendix B.

Grade Eight Reading Graphs and Tables. The eighteen scale scores from the California Psychological Inventory for the grade eight students were subjected to a discriminant analysis in which two discriminant vectors were calculated. The scaled discriminant weights associated with each of the eighteen sub-scores for each of the two vectors are shown in Table 13. The discriminant vector weights were applied to the eighteen scores for each of the grade eight students and scores for each student on the two discriminant vectors were calculated. The mean discriminant vector scores for each of the three groups are shown in Table 14, together with the grand mean of the vector scores and their standard deviation.

The position of the three group averages relative to the discriminant vectors expressed in sigma units are shown plotted in Figure 1. From Figure 1 it can be seen that the low-achievers in the grade eight Reading Graphs and Tables skills can be distinguished from the other two groups on discriminant vector II, whereas the high-achievers can be distinguished from the middle-achievers on discriminant vector I.

Reference to Table 13 will reveal that the greatest positive discriminant vector I weights were associated with Good Impression, Communality, and Social Presence. The greatest negative weights were associated with Self-Control, Sense of Well-Being, and Intellectual Efficiency. Those pupils who score high on discriminant vector I are those capable of creating a good impression and are those concerned with how others react to them. They are honest and dependable in their association with others. They have poise, self-confidence and spontaneity in personal and social interaction. On the other hand, they

TABLE 13
 SCALED DISCRIMINANT WEIGHTS BY VARIABLES
 AND BY DISCRIMINANT VECTORS

Variable	First Discriminant Vector	Second Discriminant Vector
Fx	9.83	20.56*
Gi	35.36*	14.12*
Wb	-26.53*	30.11*
Re	9.49	14.75*
Sy	3.73	11.56
Fe	1.66	9.10
Sp	17.94*	- 3.79
Do	- 4.81	-41.68*
Cs	- 5.38	12.88
Cm	32.02*	- 8.23
Py	- 6.21	8.96
Sa	- 1.58	6.44
Ac	- 7.63	-11.15*
To	- 9.45	- 4.06
So	5.59	9.44
Ie	-10.58*	- 6.86
Ai	12.07	-10.84*
Sc	-26.91*	-15.61*

*Indicates discriminant weights employed as characteristic of the particular vector.

TABLE 14
DISCRIMINANT VECTOR SCORE MEANS BY
THREE ACHIEVEMENT GROUPS

Achievement Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-Achievers	10.25	-.02	10.88	.77
Middle-Achievers	10.99	.23	8.14	-.12
High-Achievers	7.78	-.85	8.08	-.14
Combined Groups Mean	10.31		8.52	
S.D.	2.98		3.08	

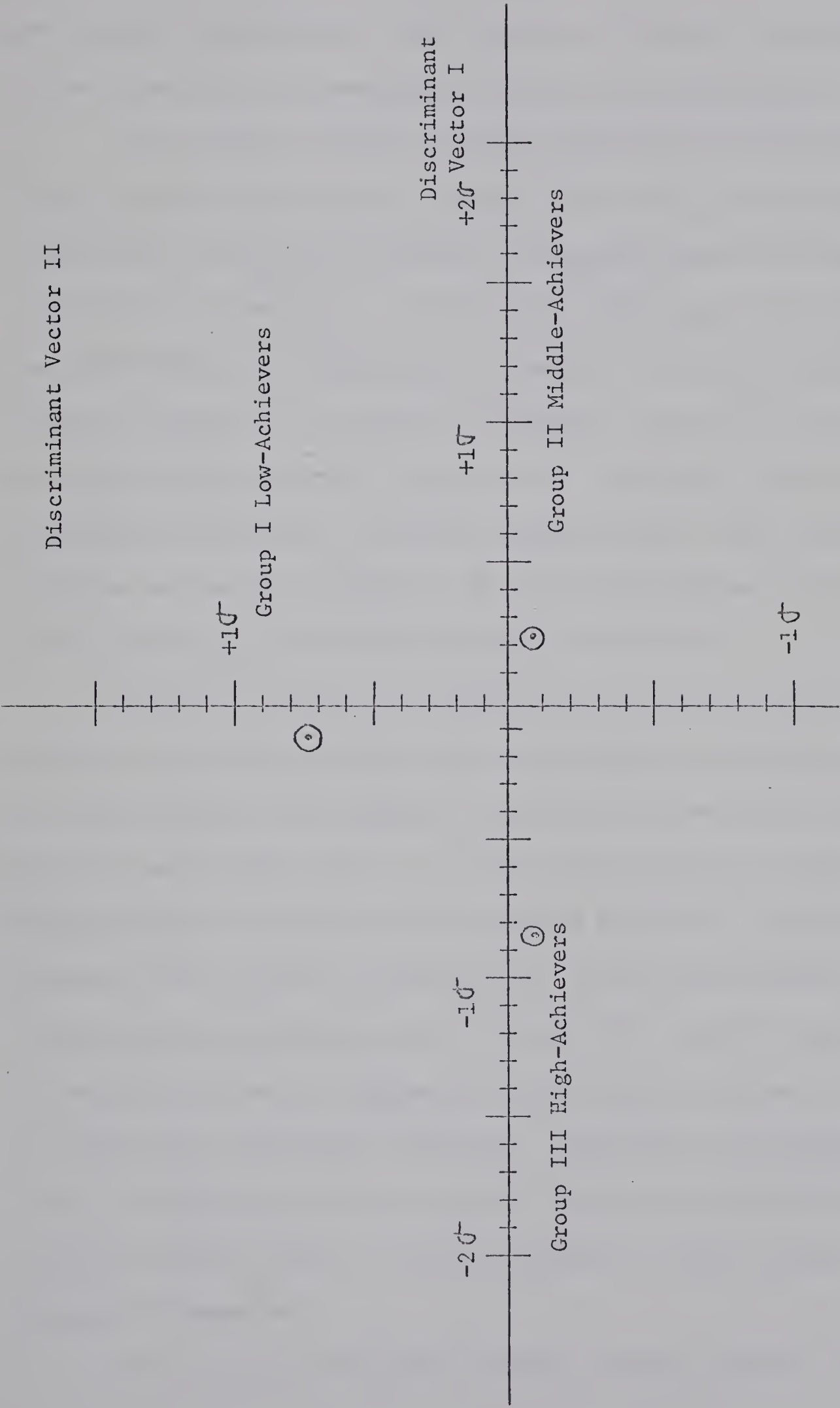


FIGURE I

DISCRIMINANT PLOT OF THREE ACHIEVEMENT GROUPS FOR GRADE EIGHT
READING GRAPHS AND TABLES SKILL SCORES

are somewhat impulsive and self-centered. The first discriminant vector appeared to be measuring a "Social-Self" dimension.

The greatest positive weights associated with discriminant vector II, were the variables Sense of Well-Being, Flexibility, Responsibility, and Good Impression. The greatest negative weights were associated with Dominance, Self-Control, Achievement via Conformance, and Achievement via Independence. Students who scored high in these areas are depicted as energetic, versatile, productive and conscientious. They are involved in social interaction. Conversely, they may also be inhibited, indifferent, shrewd and self-centered. They are often aloof, cautious and anxious students. The second discriminant vector appeared to be measuring a "flexibility-rigidity" dimension.

Table 15 contains the personality variables with the highest positive and negative weights associated with the characterization of the two orthogonal discriminant vectors for the remaining three significant basic skill areas. It would seem that for the grade seven Reading Graphs and Tables skills vector I measured a "Denying-Demanding" dimension, while vector II measured an "Industrious-Inhibited" dimension. In the grade eight Reading Comprehension skill, vector I appeared to be a "Security-Insecurity" dimension, while vector II appeared to measure an "Efficient-Inefficient" dimension. The grade nine Vocabulary vector I seemed to be a measure of an "Enterprising-Unambitious" dimension, while vector II seemed to measure a "Self-assurant-Self-abasement" dimension.

The results of this discriminant analysis were not developed

TABLE 15
SIGNIFICANT SCALED DISCRIMINANT WEIGHTS BY VARIABLES
AND BY DISCRIMINANT VECTORS

Variables	Basic Skill					
	Grade Seven Reading Graphs and Tables		Grade Eight Reading Comprehension		Grade Nine Vocabulary	
	Vector I	Vector II	Vector I	Vector II	Vector I	Vector II
Fx			20.18			
Gi	50.59	-18.31				
Wb			-36.87		-19.93	17.64
Re		-28.43		-15.98		
Sy	-23.12	20.96			21.45	
Fe						
Sp				-30.65	-14.79	
Do						
Cs				13.33	30.82	
Cm						
Py	-23.35	-18.32		-19.76		
Sa	33.28					-24.32
Ac		29.30	-21.33	19.73		
To			33.76		38.75	-26.36
So	20.79					15.92
Ie			19.55	30.13		53.65
Ai		-21.31			-17.04	-17.63
Sc	-23.90	20.18	-17.96			

any further as the results (four significant results of thirty-three analyses) were at a level of significance which could have been expected by chance. Within the three grades there were no consistent patterns within the four significant discriminant analyses and, therefore, the extraction of any more material from these analyses was meaningless.

Tables containing scaled discriminant weights by all eighteen variables for both discriminant vectors are located in Appendix B. Discriminant vector raw score means and sigma mean scores are also located in Appendix B.

The lack of significant results of the discriminant analysis raised the issue as to whether the use of regression equations containing personality variables in identifying the three achievement groups confounded the process of discrimination of students by the use of these same personality variables. To investigate the influence of the personality variables contained in the regression equations a second discriminant analysis was conducted using regression equations containing only Lorge-Thorndike predictor variables to define high, middle, and low-achievers.

The coefficients of the thirty-three regression equations which were used, together with their associated standard errors of estimate are shown in Table 16. The population of the three achievement-level groups for each basic skill are shown by grade in Table 17.

Two discriminant vectors were derived for each of the thirty-three discriminant analyses. Of the thirty-three discriminant analyses, fourteen yielded F-values which exceeded that required at the .10 level

TABLE 16

LORGE-THORNDIKE REGRESSION EQUATION COEFFICIENTS FOR

THE BASIC SKILLS FOR GRADES SEVEN, EIGHT AND NINE

Basic	Grade Seven				Grade Eight				Grade Nine			
	Verbal	Non- Verb	Con- stant	S.E. (est)	Verb	Non- Verb	Con- stant	S.E. (est)	Verb	Non- Verb	Con- stant	S.E. (est)
Voc.	0.51	0.12	- 7.61	8.20	0.46	0.06	- 3.11	6.28	0.49	0.15	- 8.66	5.34
R.Comp.	0.83	0.21	-13.35	9.52	0.63	0.33	- 8.31	10.18	0.79	0.30	-13.20	7.80
Spel.	0.46	-0.01	- 0.66	7.15	0.49	0.10	- 7.15	8.01	0.47	0.14	- 6.95	7.47
Cap.	0.34	0.04	2.25	5.87	0.12	0.22	4.59	5.87	0.14	0.26	1.79	5.21
Punc.	0.36	0.07	- 0.79	5.22	0.15	0.29	- 2.77	5.69	0.29	0.27	- 8.11	5.62
Use.	0.26	0.13	- 0.57	4.13	0.22	0.16	- 4.86	3.87	0.15	0.16	- 0.68	3.76
Map	0.24	0.14	- 2.74	4.56	0.22	0.14	- 1.79	4.23	0.16	0.23	- 0.42	4.01
R.G.T.	0.20	0.09	- 0.99	3.32	0.16	0.08	- 0.33	3.19	0.07	0.14	3.75	2.60
Ref.	0.55	0.17	- 6.81	6.85	0.41	0.32	-10.92	7.37	0.45	0.34	-13.30	6.63
Con.	0.41	0.13	- 5.00	5.14	0.13	0.34	- 6.63	5.17	0.30	0.25	- 7.63	6.22
Prob.	0.15	0.11	- 0.59	3.42	0.10	0.15	- 0.63	3.74	0.11	0.16	- 0.59	4.20

TABLE 17
POPULATION OF ACHIEVEMENT GROUPS WITHIN
EACH BASIC SKILL AREA BY GRADE

Basic Skill	Grade Seven			Grade Eight			Grade Nine		
	Low	Middle	High	Low	Middle	High	Low	Middle	High
Voc.	20	153	14				32	159	33
R.Comp.	26	136	25	23	97	21	28	164	32
Spel.	33	115	39	22	91	28	38	148	38
Cap.	27	133	27	19	95	27	33	151	40
Punc.	33	120	34	16	92	33	30	154	40
Use.	26	133	28	21	100	20	27	163	34
Map.	33	124	30	18	99	24	30	163	31
R.G.T.	35	124	28	20	99	22	38	155	31
Ref.	32	123	32	18	93	30	35	153	36
Con.	35	123	39	20	96	25	34	150	40
Prob.	31	129	27	23	90	28	36	153	35

of significance. This represented an increase of ten significant analyses over those obtained in the first discriminant analysis. The F-values and their probabilities are shown in Table 18.

Since the original intent of this study had been modified in this discriminant analysis with the deletion of the personality factors from the regression equations, and since the results of the second analysis were not much more encouraging than the first discriminant analysis, no attempt was made to describe or interpret the fourteen significant analyses. Tables of scaled discriminant weight by variables for the two discriminant vectors and discriminant vector raw score means as well as sigma mean scores are found in Appendix C. Examination of these tables indicated that there was no consistency across the grades or for personality variables related to tasks throughout the fourteen significant discriminative analyses.

A summary of the study and an interpretation of the results of the multiple regression analysis and the discriminative analyses are contained in Chapter Five.

TABLE 18
PROBABILITY VALUES FOR DISCRIMINANT ANALYSIS
OF ACHIEVEMENT IN THE BASIC SKILLS BY GRADE

Basic	Grade Seven		Grade Eight		Grade Nine	
	f	Prob.	f	Prob.	f	Prob.
Voc.	0.11	.27	_____	_____**	0.14	.08*
R.Comp.	0.15	.03*	0.12	.21	0.19	.00*
Spel.	0.85	.72	0.13	.10*	0.13	.13
Cap.	0.16	.03*	0.17	.01*	0.11	.33
Punc.	0.79	.80	0.19	.00*	0.97	.53
Use.	0.13	.13	0.17	.01*	0.18	.00*
Map	0.13	.10*	0.68	.92	0.14	.01*
R.G.T.	0.16	.02*	0.65	.94	0.11	.36
Ref.	0.98	.50	0.17	.01*	0.97	.53
Con.	0.85	.72	0.96	.54	0.12	.26
Prob.	0.14	.07*	0.12	.21	0.96	.53

*Significant at the 10% level.

**Data destroyed or lost by the computer.

The population of the three achievement groups within these fourteen significant basic skill areas is indicated in Table 12.

CHAPTER FIVE

SUMMARY, INTERPRETATION, AND IMPLICATIONS

This chapter is a summary of the intent of the study, an interpretation of the data, and finally, a discussion of implications for further research.

Summary

The matching of students and teachers according to compatible personality patterns has seemed a desirable goal to many educators. However, prior to matching students and teachers by personality patterns it must first be established that personality variables contribute to school achievement. The purpose of this study, then, was twofold: (a) to investigate whether the prediction of achievement in the basic skills of the junior high school level would be improved by employing personality variables as predictors of performance in addition to the conventional Lorge Thorndike scores, and (b) to investigate the possibility of identifying personality characteristic patterns which would discriminate among groups of students differing in achievement levels.

To achieve the first purpose regression equations were developed for each basic skill for each grade. These formulae were then applied to a cross validation sample. A discriminant analysis was then conducted to facilitate the second purpose, that of identifying personality patterns differentiating high, middle, and low achievers for each of the basic skills at each grade level.

An Interpretation of the Data

Regression Analysis. The multiple regression systems were employed to test the null hypotheses: "There are no patterns of personality characteristics which can improve in a statistically significant way the prediction of junior high school pupils' basic skill achievement obtained by use of the Lorge-Thorndike Intelligence Test alone."

A comparison between the squared multiple correlations obtained from the regression systems using both the intelligence and personality variables and those employing only the intelligence variables indicated statistically significant increases in the variance on achievement tests (Table 9). These results would indicate a basis for rejection of the first null hypotheses. Therefore, it can be concluded that there are patterns of personality characteristics which can improve upon the prediction of junior high school pupils achievement obtained from the prediction systems using only the Lorge-Thorndike Intelligence Test scores.

However, there is a difference between statistical and practical significance. Two phenomena characterized the data: improvement through the use of the personality variables differed markedly from grade to grade, and from task to task.

Grade to grade differences may be demonstrated by the use of a sign test for each pair of grades. For each of the eleven tasks within the pair of grades, a plus is given to the greater increase in variance explained by the addition of the personality variables. A comparison

between grades seven and eight indicated that the grade eight increases were greater in every instance but one. This would be expected by chance at the five per cent level. Comparison of variance increases for the eleven tasks between grades seven and nine did not indicate a significant difference. A comparison between grades eight and nine variance increases indicated that the grade eight increases were greater in every instance but two. This would be expected by chance at the five per cent level.

It would thus appear in predictive power, that the greatest gains were made at the grade eight level. The inclusion of the personality variables in the regression equations is useful for grades seven and nine but is of much greater importance to grade eight.

The influence of the variance increases in prediction achieved by the addition of personality variables in the regression equations, is not consistent throughout the three grades, however. Although statistically significant increases were achieved in some basic skill areas the resultant squared multiple correlation still remains at an inadequate level with regard to practical significance. For example, at the grade eight level, the squared multiple correlation for Capitalization is .21 with Lorge-Thorndike predictors only, and it rises to .35 when personality variables are added to the Lorge-Thorndike predictors. This represents an increase of fourteen per cent in the accountable variance but still does not reach a level useful in predicting individual performance. With a possible exception (Reading Comprehension in the eighth grade) none of the predictors would be useful

in the estimation of individual performance. The equations, however, would be useful in practical estimation of group performance.

The practical significance of the increase in the accountable variance for each basic skill by grade may be evaluated arbitrarily if the squared multiple correlations of the two sets of regression equations are classified as negligible, moderate, or high, where:

1. Negligible (N): $R^2 \leq .355$
2. Moderate (M): $.355 \leq R^2 \leq .485$
3. High (H): $R^2 \geq .485$

As no formal statistical method could be found to test the significance of these variance increases, these arbitrary points were selected so the correlations, where $r = .6$, $.6 < r < .7$, and $r \geq .7$, would be the deciding limits.

The influence of the various increases is shown for each basic skill by grade in Table 19. The greatest influence attributable to the inclusion of personality tests was at the grade eight level where nine of eleven squared multiple correlations were raised one classification, and where Spelling and Punctuation correlations were raised two classifications. In both grade seven and grade nine, four of eleven squared multiple correlations were raised one classification. At the grade seven level squared multiple correlations for Reading Comprehension, Knowledge of and Use of Reference Tables, and Mathematical Problem Solving Skills had attained the "High" classification by the Lorge-Thorndike regressions equations alone. In all three cases substantial improvement was noted by the increase of the variance with the addition

TABLE 19

INFLUENCE OF THE VARIANCE INCREASE FOR EACH BASIC SKILL BY GRADE

Basic Skill	Grade Seven		Grade Eight		Grade Nine	
	R ² Lorge Thorndike Only	R ² Lorge Thorndike & Personality	Significant Variance Improvement	R ² L-T R ² L-T & P	R ² L-T R ² L-T & P	S.V. S.V.
Voc.	M	M		M H	M	
R.Comp.	H	H	O	H	H	O
Spel.	N	N		H	M	*
Cap.	N	M	*	N	N	
Punc.	M	M		H	M	*
Use.	M	H	*	H	N	
Map	M	M		M	M	*
R.G.T.	M	H	*	M	N	
Ref.	H	H	O	H	M	*
Con.	H	H	O	H	N	
Prob.	N	M	*	M	N	

O Denotes a "high" level of classification which was added to significantly by the variance improvement.

* Denotes a rise to the next level of classification.

** Denotes a rise of two levels of classification.

of the personality variables to the regression equations. Similarly, in grade nine, the squared multiple correlation for Reading Comprehension had attained a "High" classification on the basis of the Lorge-Thorndike equations, but was substantially improved by the added variance attributed to the addition of the personality variables.

The extent of the influence of this variance improvement is demonstrated by the number of squared multiple correlations which attained the "High" classification at the grade eight level. Employing the Lorge-Thorndike predictors only, none of the squared multiple correlations attained the "High" classification, but with the addition of the personality variables, six of eleven correlations reached the "High" level. This may also be compared to only two squared multiple correlations rising to that level in grade seven, and one rising to that level in grade nine. It may be argued then, that the addition of the personality variables to the regression equations is important to the prediction of the basic skill areas for the junior high school grades, but that the greatest effect is made at the grade eight level.

It is interesting to note that the influence of the personality variables upon the variance is not consistent through the three grades, but is concentrated at the grade eight level. Why should the effect of these personality variables be slight in grade seven, greatest in grade eight, and decline in grade nine? It might be argued that the grade eight results were only statistical artifacts or a by-product of the statistical design employed in this study. However, it would seem that with the size of the total student population and the size of the grade

eight sample, the number of students was great enough to provide valid results. The high number of task areas that demonstrated improvement at the grade eight level would also seem to be greater than that which could be expected by chance. In view of the number of students employed and the number of tasks demonstrating improvement it would seem unlikely that these results could be classed as statistical artifacts.

The varying effects of the personality variables on each grade may be thought of as being controlled or influenced by the curriculum at each grade level. However, the program of studies for Alberta junior high schools indicates that all of the basic skills contained in the Canadian Test of Basic Skills are taught in all three grades. In all three grades Spelling, Vocabulary, Punctuation, Usage, Capitalization, and Reading Comprehension are taught directly as writing skills. In the area of mathematics, although the materials taught varies through the grades, the objectives of the course remain the same. Contained within these objectives is the development of the understanding of mathematical concepts, and the development of systematic methods of analyzing problems and of presenting their solutions.

It is only in the social science area where the basic skills are not treated directly by the junior high school curriculum. The emphasis seems to be more on self-exploration with the material in grade seven and eight being basically sociological in nature. At the grade nine level, geography, human and natural resources, industrial expansion, South American development, and politics make up the curriculum. The Work Study Skill of Map Reading is not taught or dealt with in any

direct manner. Reading Graphs and Tables, as well as Knowledge and Use of Reference Materials are two of the main skills about which the junior high school curriculum is constructed.

It would seem then that the curriculum generally did not control the influence of the personality variables in predicting achievement. However, it may be argued that in specific areas a concentration of material was taught at a particular grade level, thus controlling the personality variable influence. For example, the grade nine social science curriculum lends itself to direct teaching and practical experience in Map Reading, whereas this is not so at the grade seven or eight levels. Table 19 indicates no significant increases in this area except at the grade nine level. Therefore, specific emphasis on particular skills at any grade level may have been an influencing factor.

The test employed as a measure of junior high school achievement might be considered a source of influence on the personality variance increase. However, from the preceding discussion, it would seem that the Canadian Test of Basic Skills agrees very well with the Alberta junior high school program of studies. The only way in which it may be deemed inappropriate is that it was designed to test only grades three to eight. In this case it has been used at the grade nine level, but it still meets the objectives of the grade nine curriculum.

The pattern of personality variance increases in the three grades may be influenced by the expectations and perceptions of the students in each of the three grades. Grade seven students have entered a new academic setting which places a great amount of responsibility

upon the student and somewhat less upon the teacher. Now in grade seven the student must learn what is required of him by the teacher and he must learn to depend less on the teacher. As a grade seven student he must overcome the mystique of the junior high school that he has developed during the previous two years.

Such is not the case for the grade eight students who have had one year of junior high school in which to find themselves. Having learned what is expected of them and what they may expect in return, they face a very settled year of academic work. Grade nine students, although they have made the same assessments as the grade eight students, face different problems again. They must prepare for entry into high school, they must provide leadership at the junior high school level, and they are at an age where physiologically and sociologically they are entering into a new world of personal problems. They are then facing a very unsettled year of academic study. It may be argued, therefore, that the specific grade patterns of expectations and perceptions by the students may influence the personality variance increase.

The personality variance increase is a result of a single criterion being predicted by a relationship between several predictor variables. This relationship or multiple correlation appears when inter-correlation between predictor variables have been accounted for. A direct relationship between two single and independent variables is a first order correlation and they appear in the inter-correlation matrix between all criterion and predictor variables.

A comparison of the first order correlations (Tables 2-4) with

the multiple correlations expressed through the regression equations (Tables 5-7) will indicate apparent differences. The equation for grade seven Vocabulary does not contain the Lorge-Thorndike non-verbal variable but the first order correlation (Table 2) indicates a correlation between these two variables of .45. The reason for this omission is the correlation of .62 between the verbal and non-verbal variables of the Lorge-Thorndike Intelligence Test. As the variables enter the equations through a step-wise multiple regression, variables contributing to the variance in the greatest amount are added first. The inter-correlation between the two Lorge-Thorndike variables indicates that when the verbal variable was added to the regression equation it reduced the variance contribution of the non-verbal variable. This reduction was great enough to reduce the effect of the non-verbal contribution to the variance to a point whereby it was no longer an influencing factor.

The variable Socialization demonstrated a higher correlation with grade seven Vocabulary than several of the variables expressed in the regression equation (Tables 2 and 5). However, examination of the first order correlation matrix indicated that Socialization has a high correlation with the variables Verbal, Sense of Well-Being, Communalilty, and Achievement via Independence. As these variables are expressed in the regression equation, they have accounted for the greatest portion of the variance represented by Socialization. Therefore, Socialization does not appear in the regression equation for grade seven Vocabulary.

A single variable may contribute to the effectiveness of a multiple regression equation by providing additional valid variance or it may act to measure the non-valid variance which appears in a valid equation. Variables which measure non-valid variance are suppressor variables and generally it will show a high correlation with the test for which it is a suppressor but a low correlation with the criterion. This type of test will enter into a composite prediction with a negative weight.

The personality variable Good Impression appeared as a negative first order correlation for all three grades and demonstrated a low correlation with the criterion. It was expressed as a high negative loading factor in the grade eight and nine regression systems. The first order correlation at the grade eight and nine levels between Good Impression and other personality variables was high. In those grade eight regression equations containing the personality variables Sense of Well-Being, Responsibility, Femininity, Tolerance, Achievement via Independence, Self Control, and the non-verbal intelligence variable, Good Impression was functioning as a suppressor variable. Similarly, at the grade nine level for those equations containing the personality variables Intellectual Efficiency, Self Control, Achievement via Conformance, Socialization, Sense of Well-Being, Responsibility, and Achievement via Independence, Good Impression functioned as a suppressor variable.

Therefore, it may be argued that the function of the variable Good Impression in the regression systems for grade eight and nine is

to partial out the non-valid variance from an otherwise valid equation, making the multiple score a purer measure.

The multiple correlation analysis provided regression equations for the prediction of the criterion variables from a composite of several personality variables. However, it is possible to identify by grade those first order variables which would seem to be predictors for each grade. If a correlation of .30, appearing on seven of the eleven tasks, is arbitrarily assigned as the level at which a personality variable might be expected to contribute to the prediction of a basic skill then from Tables 2-4, the grade predictors are:

- | | |
|-----------------------|----------------------------|
| 1. <u>Grade Seven</u> | a) Communality |
| | b) Socialization |
| | c) Sense of Well-Being |
| | d) Intellectual Efficiency |
| 2. <u>Grade Eight</u> | a) Responsibility |
| | b) Communality |
| | c) Intellectual Efficiency |
| | d) Femininity |
| | e) Socialization |
| 3. <u>Grade Nine</u> | a) Intellectual Efficiency |

Table 10 contains those variables associated with the prediction of each basic skill by grade as a result of the multiple regression analysis. If a frequency of six of eleven tasks is arbitrarily assigned as the level of which a personality variable might be expected to contribute to the prediction of a basic skill, then the composite grade

predictors may be expressed as:

- | | |
|-----------------------|----------------------------|
| 1. <u>Grade Seven</u> | 1) Communalinity |
| | 2) Sense of Well-Being |
| 2. <u>Grade Eight</u> | 1) Femininity |
| | 2) Sense of Well-Being |
| 3. <u>Grade Nine</u> | 1) Intellectual Efficiency |

On the basis of the composite grade predictors, it may be argued that when predictor equations are used to predict success in the basic skill areas that a set of personality characteristics are indicative of the prediction at each grade level. These sets of personality characteristics are:

- | | | |
|-----------------------|-------------------|-----------------|
| 1. <u>Grade Seven</u> | a) Dependable | f) Energetic |
| | b) Tactful | g) Enterprising |
| | c) Reliable | h) Ambitious |
| | d) Sincere | i) Versatile |
| | e) Conscientious | |
| 2. <u>Grade Eight</u> | a) Outgoing | e) Energetic |
| | b) Ambitious | f) Enterprising |
| | c) Robust | g) Versatile |
| | d) Active | |
| 3. <u>Grade Nine</u> | a) Efficient | |
| | b) Clear Thinking | |
| | c) Progressive | |
| | d) Resourceful | |

When a comparison is made between prediction for the basic skills

by first order correlations and prediction by a composite equation in grade nine only the single variable of Intellectual Efficiency is the same for both systems. At the grade seven level only Communality is found in both systems while at the grade eight level Femininity is the one variable common to both systems.

When the multiple correlation equations were considered for each skill area it was found that there were no equations which contained similar personality variables across the three grade levels. There was some agreement between grades seven and eight as six of the eleven skill areas contained similar personality variables. Grade eight and nine equations demonstrated a similarity in that ten of the eleven skills contained similar personality variables. Only four of the grade seven and nine equations had similar personality variables for the respective skill areas.

The number of similar variables within the equations for each task ranged from one between grades seven and eight to two between grades eight and nine. Therefore, there is no possibility of developing a pattern of variables which would predict a particular basic skill for all three grade levels. It would seem, therefore, that the greatest practical significance of the multiple predictor equations is the prediction of a Single Basic Skill for a specific junior high school grade.

Discriminant Analyses. A discriminant analysis was employed to test the null hypothesis: "There are no patterns of personality characteristics which discriminate among groups of high-achievers,

middle-achievers, and low-achievers in the junior high school basic skills, when achievement-level groups are defined in terms of expectations of achievement on the basis of their Lorge-Thorndike Test scores and the California Personality Inventory Test scores."

The results of the three group discriminant analysis carried out for each of the basic skills at each grade level (four significant results of thirty-three analyses) were at a level of significance which could have been expected by chance. Within the four significant analyses no consistent patterns of discriminating characteristics emerged.

A second discriminant analysis employing Lorge-Thorndike scores only, as predictors, provided results (fourteen significant results of thirty-three analyses) which were little more encouraging than the first discriminant analysis. Since the second discriminant analysis, through the loss of the predictor personality variables, did not meet the criteria of the study, and since the results of the first discriminant analysis could have been expected by chance, it was not possible to reject the second null hypothesis. Therefore, it must be concluded that there are no patterns of personality characteristics which discriminate among groups of high-achievers, middle-achievers, and low-achievers in the junior high school basic skills, when achievement-level groups are defined in terms of expectations of achievement on the basis of their Lorge-Thorndike Test scores and the California Psychological Inventory scores.

Implications

The prediction of achievement has been improved at a practical level by the addition of personality variables to the measures of intelligence; however, the results of the entire multiple regression analysis were not encouraging. The multiple regression systems did demonstrate practical significance but failed to demonstrate consistency from grade to grade or from task to task. The value of the predictor equation remains then as a means of estimation for a single skill for a particular grade. The variance increases exhibited by the addition of the personality variables warrant no further work in this area.

The discriminant analysis did not produce any significant results but would have served a useful purpose if it had. It would seem that a method of characterizing students within achievement level groups would be a useful procedure for teachers and, therefore, this area might be pursued.

It may be argued that one of the problems encountered in the discriminant analysis was the large number of personality variables employed. The initial correlation matrix indicated that the inter-correlations of the personality variables were high in many cases and the use of all eighteen variables may have tended to confound the results of the discriminant analyses. The use of fewer personality variables may eliminate this problem. Several authors (Appendix A) have suggested that the California Psychological Inventory contains from four to six factors depending upon the factor analysis employed. Employing four or six factors rather than eighteen may allow the

development of a significant discriminant analysis and a procedure for characterizing achievement-level groups.

In an effort to achieve this end, it would be recommended that:

1. In an attempt to improve the personality variables for the discriminant analysis, some form of a factor analysis must be employed on the California Psychological Inventory.
2. A test employing only five or six personality factors replace the California Psychological Inventory.
3. That the Canadian Test of Basic Skills be replaced with classroom achievement grades if these are the result of common tests written across each grade or if each student in a grade level is taught the same subject by the same teacher.

BIBLIOGRAPHY

- Ausubel, David P., Theory and Problems of Adolescent Development, New York, Greene and Stratton Inc., 1954, p. 23.
- Barrelleaux, L. E., "High School Science Achievement as Related to Interest and I.Q.," Educational and Psychological Measurement, Vol. 21, No. 4, Winter 1961, pp. 929-936.
- Bouchard, John M., "A Pupil-Oriented Individualized System of Education: Guidelines for Implementation," Bulletin of the Teacher Education Research Center, State University of New York, Fredonia, N.Y., 1970, p. 6.
- Breaux, Mary Angelina, Sister, "Selected Personality Characteristics and Their Relationships to Academic Achievement (Columbus, Ohio) 1963," Thesis: Ohio State University, Microfilm Copy of Typescript, Ann Arbor University Microfilms, 1964.
- Buros, Oscar K., The Fifth Mental Measurement Yearbook, Highland Park, N.J., Gryphon Press, 1959, pp. 30-37.
- Cattell, R. B., Sealey, A. P., and Sweney, A. B., "What Can Personality and Motivation Source-Trait Measurements Add to the Prediction of School Achievement?" British Journal of Educational Psychology, Vol. 36, November 1966, pp. 280-295.
- Cooley, W. W., and Glasser, R., "The Computer and Individualized Instruction," Science (166), 1969, pp. 574-582.
- Crites, J. O., "The California Psychological Inventory: I. As a Measure of the Normal Personality," Journal of Counselling Psychology, Vol. 11, No. 2, 1964, pp. 197-212.
- Crites, J. O., "The California Psychological Inventory: II. As a Measure of Client Personalities," Journal of Counselling Psychology, Vol. 11, No. 3, 1964, pp. 299-306.
- Crites, J. O., Bechtoldt, H. P., Goodstein, L. D., and Heilbrun, A. B., "Factor Analysis of the California Psychological Inventory," Journal of Applied Psychology, Vol. 45, No. 6, 1961, pp. 408-414.
- Cronbach, L. J., "The California Psychological Inventory," Buros, O.K., (Editor), The Fifth Mental Measurement Yearbook, Highland Park, N.J., The Gryphon Press, 1959.
- Domino, George, "Differential Prediction of Academic Achievement in Conforming and Independent Settings," Journal of Educational Psychology, Vol. 59, August 1968, pp. 256-260.

- Draper, N. R., and Smith, H., Applied Regression Analysis, John Wiley and Sons Inc., New York, 1966, pp. 171-172; 178-195.
- Frost, B. P., "Some Conditions of Scholastic Achievement: Intelligence and Aptitudes," Canadian Educational Research Digest, Vol. 5, December 1965, pp. 267-275.
- Gough, H. G., California Psychological Inventory Manual, Palo Alto, California, Consulting Psychologists Press, Inc., 1956.
- Gough, H. G., "Academic Achievement in High School as Predicted from the California Psychological Inventory," Journal of Educational Psychology, Vol. 55, 1964, pp. 174-180.
- Holland, J. L., "The Prediction of College Grades from the California Psychological Inventory and the Scholastic Aptitude Test," Journal of Educational Psychology, Vol. 50, 1959, pp. 135-142.
- Holowinsky, I., "Relationship Between Intelligence (80-110 I.Q.) and Achievement in Basic Educational Skills," Training School Bulletin, Vol. 58, May 1961, pp. 14-22.
- Keimowitz, R. I., and Ansbacher, H. L., "Personality and Achievement in Mathematics," Journal of Individual Psychology, Vol. 16, 1960, pp. 84-87.
- Keller, E. D., and Rowley, V. N., "The Relations Among Anxiety Intelligence and Scholastic Achievement in Junior High School Children," Journal of Educational Research, Vol. 58, December 1964, pp. 167-170.
- Kelly, F. J., Beggs, D. L., and McNeil, K. A., Multiple Regression Approach, Southern Illinois University Press, 1969, pp. 234-240.
- King, E. M., Canadian Test of Basic Skills Manual for Administrators, Supervisors and Counsellors, Thomas Nelson and Sons, Ontario, Canada, 1968.
- Koenig, Kathryn and McKeachie, W. J., "Personality and Independent Study," Journal of Educational Psychology, Vol. 50, No. 3, 1959, pp. 132-134.
- Lessinger, L. M. and Martinson, Ruth A., "The Use of the California Psychological Inventory with Gifted Pupils," Personnel and Guidance Journal, Vol. 39, 1961, pp. 572-575.
- Liddle, Gordon, "The California Psychological Inventory and Certain Social Personal Factors," Journal of Educational Psychology, Vol. 49, No. 3, 1958, pp. 144-149.

- Lindvall, C. M. and Bolvin, J. O., "Programmed Instruction in the Schools: An Application of Programming Principles in Individually Prescribed Instruction," National Society for the Study of Education Yearbook, 66, pt. 2, 1967, pp. 217-254.
- Linton, Thomas E., "The C.P.I. as a Predictor of Academic Success," Alberta Journal of Educational Research, Vol. XIII, No. 1, March 1967, pp. 59-64.
- Lorge, I. and Thorndike, R. L., Examiner's Manual, Lorge-Thorndike Intelligence Tests, Cambridge, Houghton Mifflin Company, Boston Riverside Press, 1954.
- Mitchell, J. V. and Pierce-Jones, J., "A Factor Analysis of Gough's California Psychological Inventory," Journal of Consulting Psychology, Vol. 24, 1960, pp. 453-456.
- Nichols, R. C. and Schnell, R. R., "Factor Scales for the California Psychological Inventory," Journal of Consulting Psychology, Vol. 27, 1963, pp. 228-235.
- Nyberg, V. R., Bay, K., Chan, K. S., Jurkat, E., Taylor-Pearce, M., "Canadian Test of Basic Skills. A User's Appraisal," A Paper Presented at the Convention of the Canadian Guidance and Counseling Association, Edmonton, Alberta, June, 1969.
- Pierce, J. V., "Personality and Achievement Among Able High School Boys," Journal of Individual Psychology, Vol. 17, 1961, pp. 102-107.
- Remmers, H. H., "Review of Iowa Test of Basic Skills," Buros, O. K., (Editor), The Fifth Mental Measurement Yearbook, Englewood Cliffs, N.J., Gryphon Press, 1959.
- Snider, J. G. and Linton, T. E., "The Predictive Value of the California Psychological Inventory in Discriminating Between the Personality Patterns of High School Achievers and Under-Achievers," Ontario Journal of Educational Research, Vol. 6, No. 2, Spring 1964, pp. 107-115.
- Snider, J. G., "Academic Achievement and Underachievement in a Canadian High School as Predicted from the California Psychological Inventory," Psychology in the Schools, Vol. 3, 1966, pp. 370-372.
- Springob H. K. and Struening, E. L., "A Factor Analysis of the California Psychological Inventory on a High School Population," Journal of Counselling Psychology, Vol. 11, No. 2, 1964, pp. 173-179.
- Tate, Merle W., and Clelland, Richard C., Nonparametric and Shortcut Statistics, Interstate Printers and Publishers Inc., Danville, Illinois, 1957, pp. 100-101.

- Thelen, Herbert A., "Classroom Grouping of Students," School Review, Vol. 67, 1959, pp. 60-78.
- Thelen, Herbert A., "Grouping for Teachability," Theory Into Practice, Vol. 2, 1963, pp. 81-89.
- Thelen, Herbert A., "Matching Teachers and Pupils," N.E.A. Journal, Vol. LVI, April 1967 a, pp. 18-20.
- Thelen, Herbert A., Classroom Grouping for Teaching, New York, John Wiley and Sons Inc., 1967 b.
- Thorndike, R. L., Personnel Selection Test and Measurement Techniques, John Wiley and Sons Inc., New York, 1949, pp. 185-226.
- Yates, Alfred, "Grouping in Education," A Report Sponsored by the U.N.E.S.C.O. Institute for Education, Hamburg, New York, John Wiley and Sons Inc., 1966, pp. 73-74.

APPENDICES

APPENDIX A

FACTOR ANALYSIS OF THE CALIFORNIA PSYCHOLOGICAL INVENTORY

APPENDIX A

Factor AnalysisReview of Literature on the C.P.I.

<u>Gough</u>	<u>Mitchell & Pierce-Jones</u>	<u>Crites, Bechtold, Goldstein & Heilbron</u>		<u>Nichols & Schnell</u>
<u>Factor A</u>	<u>Factor A</u>	<u>Factor A</u>	<u>(Reduced Set of Factors)</u>	<u>Factor A</u>
Do	Do	Do		Do
Cs	Cs	Cs		
Sy	Sy	Sy	Do	Sy
Sp	Sp	Sp		Sp
Sa	Sa	Sa		Sa
Wb				
<u>Factor B</u>	<u>Factor B</u>	<u>Factor B</u>		<u>Factor B</u>
Re	Sc	Cm		Wb
So	Gi	Wb		Re
Sc	Ac	Re		So
To	Wb	So	(a) Cm	Sc
Gi	To	Sc		To
Cm	Re	To		Gi
		Gi	(b) Gi	Ac
<u>Factor C</u>	<u>Factor C</u>	<u>Factor C</u>		<u>Factor C</u>
Ac	Re	Ie		
Al	Cm	Ac	Ie	Fx
Ie	So	Ai		
	Fe			
<u>Factor D</u>	<u>Factor D</u>	<u>Factor D</u>		
Py	To	Fx	(a) Fx	
Fx	Ie			
Fe	Cs	Fe	(b) Fe	
	Fx			
	Sp			
	Ai			

APPENDIX A (continued)

Factor AnalysisReview of Literature on the C.P.I.

Composite Factor From
Mitchell-Pierce Crites
et. al.

Nichols Schnell

(See Test Review #1)

<u>Springob</u>		<u>Grites</u>	
<u>Factor A</u>	(Reduced Set of Factors)	<u>Factor A</u>	
Do		Do	
Cs		Cs	
Sy	Sy	Sy	
Sp	Do	Sp	
Sa	Cs	Sa	
	3		
<u>Factor B</u>		<u>Factor B</u>	<u>Factor E</u>
Sc		Sc	Fe
To		Ac	
Ac		Wb	
Wb	Sc	Gi	<u>General Factor</u>
Gi	To	So	Ie
So	Ac	Re	
	3		
Re		To	
Ie		Py	
Ai		Ai	
Py			
<u>Factor C</u>		<u>Factor C</u>	
Ai		Cm	
Fx	Fx	Sc	
		Re	
<u>Factor D</u>		<u>Factor D</u>	
Cm	Cm	Fx	
		To	
		Py	
		Ai	
		Cs	
		Sp	
<u>Factor E</u>			
Fe	Fe		
Re			

APPENDIX B

DATA FOR THE FIRST DISCRIMINANT ANALYSIS

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

Variable	Grade Seven Reading Graphs and Tables		Grade Eight Reading Comprehension		Grade Nine Vocabulary	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	3.23	6.07	20.18	- 6.47	8.22	6.64
Gi	50.59	-18.31	3.89	- 4.00	-12.21	- 6.66
Wb	13.41	-13.35	-36.87	4.85	-19.93	17.64
Re	2.30	-28.43	9.02	-15.98	6.22	10.93
Sy	-23.12	20.96	3.84	- 8.11	21.45	14.47
Fe	3.42	9.54	- 4.46	- 4.28	-10.14	5.57
Sp	4.39	- 3.32	-12.83	-30.65	-14.79	-16.83
Do	-17.21	9.12	6.74	3.16	7.90	- 1.04
Cs	7.00	7.68	- 7.91	13.33	30.82	- 1.80
Cm	-17.39	-15.88	8.05	- 2.34	3.69	- 3.17
Py	-23.35	-18.32	0.49	-19.76	0.42	0.54
Sa	33.28	10.56	14.05	-15.84	-13.78	-24.32
Ac	- 3.59	29.30	-21.33	19.73	15.97	- 5.24
To	4.20	- 5.86	33.76	6.87	38.75	-26.36
So	20.79	4.58	8.49	- 3.21	-12.60	15.92
Ie	- 9.43	- 4.03	19.55	30.13	-11.26	53.65
AI	2.19	-21.31	-14.06	- 5.25	-17.04	-17.63
Sc	-23.90	20.18	-17.96	- 8.87	- 2.42	-16.45

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE SEVEN - READING GRAPHS AND TABLES

GRADE EIGHT - READING COMPREHENSION

Reading Graphs and Tables				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	2.48	-0.23	- 1.07	0.23
Middle-achievers	2.69	-0.16	- 3.29	-0.14
High-achievers	6.36	0.98	- 2.64	0.04
Combined Groups				
Mean	3.20		- 2.76	
S.D.	3.20		2.97	

Reading Comprehension				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	0.14	-0.78	-21.08	-0.43
Middle-achievers	3.33	0.26	-20.10	-0.06
High-achievers	1.43	-0.36	-18.19	0.65
Combined Groups				
Mean	2.53		-19.93	
S.D.	3.05		2.72	

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE NINE -- VOCABULARY

Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	-3.13	-0.80	8.35	0.12
Middle-achievers	-0.11	0.16	8.40	0.13
High-achievers	-0.59	0.01	5.12	-0.86
Combined Groups				
Mean	-0.63		7.97	
S.D.	3.12		3.33	

APPENDIX C

DATA FOR THE SECOND DISCRIMINANT ANALYSIS

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE SEVEN - MAP READING AND READING GRAPHS AND TABLES

Variable	Map Reading		Reading Graphs and Tables	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	15.82	- 0.52	- 2.31	- 9.71
Gi	- 2.30	-10.57	29.65	- 3.53
Wb	- 4.22	- 9.41	16.61	- 0.46
Re	-16.33	2.36	- 3.75	26.53
Sy	- 8.89	11.29	-11.79	-11.65
Fe	26.84	- 0.01	-21.15	-16.72
Sp	15.66	1.49	12.25	- 9.54
Do	4.85	26.19	3.94	- 2.92
Cs	-15.70	-20.33	-13.77	2.74
Cm	-10.49	-25.71	10.01	11.97
Py	- 7.26	9.19	-15.63	10.91
Sa	- 7.95	2.46	7.46	2.20
Ac	- 8.01	5.97	-12.94	-11.48
To	13.61	- 9.87	19.28	-17.32
So	28.64	26.49	15.59	-17.12
Ie	11.68	-22.48	-12.18	18.48
Ai	-18.07	17.87	0.87	27.08
Sc	4.02	- 0.52	-23.23	-13.28

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE SEVEN - MAP READING AND READING GRAPHS AND TABLES

Map Reading				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	11.95	0.95	2.22	-0.09
Middle-achievers	8.87	-0.16	2.88	0.13
High-achievers	8.16	-0.41	1.18	-0.43
Combined Groups				
Mean	9.30		2.49	
S.D.	2.78		3.02	

Reading Graphs and Tables				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	- 2.00	-0.25	-4.47	-0.66
Middle-achievers	- 1.72	-0.16	-2.23	0.20
High-achievers	1.86	1.02	-2.92	-0.06
Combined Groups				
Mean	- 1.24		-2.75	
S.D.	3.03		2.59	

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE SEVEN - READING COMPREHENSION AND CAPITALIZATION

Variable	Reading Comprehension		Capitalization	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	- 6.74	- 2.44	1.01	- 2.90
Gi	- 2.79	4.09	1.99	11.99
Wb	- 3.50	-10.59	-28.12	-24.74
Re	11.91	2.47	17.12	-22.47
Sy	- 7.28	-12.84	-11.57	12.56
Fe	- 8.16	10.38	-17.83	5.21
Sp	-30.57	9.74	- 6.73	- 0.26
Do	14.34	3.33	0.71	0.33
Cs	9.30	-13.36	10.54	- 1.34
Cm	7.77	-28.20	-21.34	-11.61
Py	2.23	- 0.99	17.55	-14.31
Sa	-13.67	21.63	- 9.63	8.21
Ac	3.37	-17.05	14.48	-19.59
To	- 2.77	0.20	-16.24	- 8.64
So	-15.75	26.63	25.26	19.20
Ie	7.32	33.33	12.48	11.97
Ai	34.83	- 2.04	1.34	24.27
Sc	- 8.84	-22.14	- 2.92	20.60

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE SEVEN - READING COMPREHENSION AND CAPITALIZATION

Reading Comprehension				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	4.75	-0.87	-3.25	-0.45
Middle-achievers	7.71	0.03	-1.76	0.20
High-achievers	10.00	0.73	-3.59	-0.60
Combined Groups				
Mean	7.60		-2.22	
S.D.	3.29		2.31	

Capitalization				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	- 0.97	0.81	3.25	0.47
Middle-achievers	- 3.57	-0.03	1.34	-0.22
High-achievers	- 5.62	-0.68	3.60	0.59
Combined Groups				
Mean	- 3.49		1.94	
S.D.	3.11		2.79	

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE SEVEN - MATHEMATICAL PROBLEM SOLVING AND

GRADE EIGHT - SPELLING

Variable	Problem Solving		Spelling	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	-27.71	6.89	2.16	13.78
Gi	-11.53	12.92	- 5.07	11.05
Wb	- 3.36	- 5.59	10.83	-28.44
Re	- 0.21	-18.81	-20.71	7.24
Sy	- 6.90	-14.95	-17.28	21.88
Fe	-21.25	4.30	34.88	- 5.09
Sp	9.96	-15.67	3.32	-14.13
Do	- 0.05	17.66	- 3.25	-15.35
Cs	- 0.66	5.97	13.85	5.52
Cm	-21.38	- 6.06	- 4.35	14.58
Fy	4.39	14.97	0.12	13.08
Sa	11.48	- 7.67	2.09	- 0.15
Ac	- 7.93	27.15	6.10	6.05
To	8.74	9.04	6.90	4.62
So	12.91	- 2.55	9.72	6.03
Ie	-18.75	13.02	25.09	- 3.64
Ai	15.31	-15.55	-14.90	3.98
Sc	6.84	-28.12	-21.46	-34.91

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE SEVEN - MATHEMATICS PROBLEM SOLVING

GRADE EIGHT - SPELLING

Mathematics Problem Solving				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	1.77	0.76	-4.84	-0.38
Middle-achievers	- 0.39	-0.03	-3.21	0.19
High-achievers	- 2.30	-0.76	-5.10	-0.47
Combined Groups				
Mean	- 0.32		-3.76	
S.D.	2.75		2.84	

Spelling				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	9.49	-0.98	0.61	0.35
Middle-achievers	13.63	0.03	-1.02	-0.22
High-achievers	16.21	0.66	0.87	0.44
Combined Groups				
Mean	13.49		-0.39	
S.D.	4.08		2.88	

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE EIGHT -- LANGUAGE USAGE AND

KNOWLEDGE AND USE OF REFERENCE TABLES

Variable	Language Usage		Reference Tables	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	-14.39	- 2.25	3.87	13.62
Gi	- 4.84	12.94	-11.18	- 1.28
Wb	31.54	- 8.85	29.35	4.34
Re	-17.82	-11.89	0.56	- 7.27
Sy	- 2.16	2.03	10.69	19.91
Fe	19.97	- 2.45	17.43	-14.01
Sp	3.97	-13.46	- 8.25	- 4.45
Do	-13.99	0.72	- 0.55	- 7.24
Cs	11.38	-14.96	4.45	-10.72
Cm	- 3.64	- 2.26	-28.99	-22.86
Py	- 4.44	- 7.48	8.57	16.43
Sa	- 4.99	27.79	- 3.54	9.65
Ac	9.23	- 0.89	- 1.68	- 1.60
To	19.03	25.01	-19.18	8.46
So	- 7.88	- 7.55	24.80	21.55
Ie	11.28	5.89	20.44	-10.31
Ai	9.73	2.67	-14.70	- 9.06
Sc	-29.89	-10.28	-17.81	2.86

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS
 GRADE EIGHT - LANGUAGE USAGE AND KNOWLEDGE AND USE
 OF REFERENCE TABLES

Language Usage				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	2.97	-1.26	-3.11	-0.04
Middle-achievers	8.63	0.21	-2.58	0.17
High-achievers	8.95	0.29	-4.99	-0.82
Combined Groups				
Mean	7.83		-3.00	
S.D.	3.84		2.44	

Knowledge and Use of Reference Tables				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	2.87	-1.33	0.37	-0.28
Middle-achievers	8.07	0.07	1.60	0.20
High-achievers	9.99	0.59	-0.08	-0.45
Combined Groups				
Mean	7.82		1.08	
S.D.	3.71		2.58	

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE EIGHT - CAPITALIZATION AND PUNCTUATION

Variable	Capitalization		Punctuation	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	-18.44	- 2.30	5.40	- 2.43
Gi	- 7.54	4.72	- 6.59	-14.71
Wb	19.79	-14.26	28.69	- 8.34
Re	- 9.85	32.15	-29.98	14.13
Sy	-18.78	- 8.46	0.72	-26.86
Fe	18.60	12.33	10.15	12.61
Sp	- 5.07	10.65	- 0.03	9.15
Do	- 8.12	16.23	17.38	- 9.75
Cs	14.31	8.44	- 5.12	23.49
Cm	- 0.55	-22.79	-14.25	- 6.73
Py	- 3.71	- 6.83	13.59	1.50
Sa	18.26	-10.36	-17.50	10.18
Ac	- 2.09	-14.64	- 8.10	11.29
To	4.10	-18.56	6.51	- 6.23
So	4.70	- 2.91	25.01	4.47
Ie	22.49	24.66	5.86	11.66
Ai	- 3.61	0.94	0.34	-20.14
Sc	-12.79	- 9.52	- 7.85	6.28

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE EIGHT - CAPITALIZATION AND PUNCTUATION

Capitalization				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	6.46	-0.93	4.32	0.66
Middle-achievers	9.76	-0.06	1.69	-0.26
High-achievers	13.22	0.86	3.70	0.45
Combined Groups				
Mean	9.98		2.43	
S.D.	3.77		2.85	

Punctuation				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	1.22	-1.57	9.18	-0.03
Middle-achievers	7.38	0.21	8.69	-0.21
High-achievers	7.25	0.17	10.85	0.22
Combined Groups				
Mean	6.65		9.25	
S.D.	3.46		2.68	

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE NINE - VOCABULARY AND READING COMPREHENSION

Variable	Vocabulary		Reading Comprehension	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	-19.01	22.50	3.31	- 5.85
Gi	-43.80	12.47	33.64	-16.84
Wb	2.82	-14.31	3.66	- 4.64
Re	- 2.88	2.77	- 6.89	1.55
Sy	- 0.68	21.29	-10.56	23.82
Fe	0.48	-18.40	- 7.35	5.36
Sp	-11.97	-23.58	- 6.07	-22.80
Do	13.23	- 4.42	- 0.08	-19.05
Cs	15.98	13.12	1.60	37.02
Cm	-14.95	12.09	-27.21	-17.65
Py	1.37	- 2.43	19.26	- 5.30
Sa	3.57	-21.30	12.12	- 9.15
Ac	- 3.51	7.80	- 4.91	19.27
To	16.55	-11.97	- 0.73	- 6.55
So	-11.18	5.45	17.54	- 0.96
Ie	22.75	25.62	-20.61	9.40
Ai	- 8.48	-21.97	- 0.87	- 7.73
Sc	36.55	- 0.47	-11.25	14.16

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE NINE - VOCABULARY AND READING COMPREHENSION

Vocabulary				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	- 1.78	-0.71	-0.32	-0.39
Middle-achievers	0.25	-0.02	0.95	0.15
High-achievers	2.54	0.77	-0.19	-0.34
Combined Groups				
Mean	0.30		0.60	
S.D.	2.91		2.36	

Reading Comprehension				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	- 9.62	1.18	-6.04	0.17
Middle-achievers	-13.45	-0.11	-6.86	-0.14
High-achievers	-14.48	-0.46	-5.02	0.56
Combined Groups				
Mean	-13.12		-6.50	
S.D.	2.96		2.65	

SCALED DISCRIMINANT WEIGHTS BY VARIABLES AND BY DISCRIMINANT VECTORS

GRADE NINE - LANGUAGE USAGE AND MAP READING

Variable	Language Usage		Map Reading	
	Discriminant Vector I	Discriminant Vector II	Discriminant Vector I	Discriminant Vector II
Fx	-21.09	14.45	8.39	-24.09
Gi	-21.49	-14.02	4.60	6.39
Wb	39.10	-25.17	35.87	26.84
Re	-14.78	12.67	-24.93	- 0.77
Sy	- 7.83	15.75	-33.75	- 5.50
Fe	32.26	7.70	22.48	9.35
Sp	-13.08	20.99	0.67	13.93
Do	1.16	- 2.85	6.91	12.42
Cs	18.09	- 2.69	- 8.72	5.24
Cm	-16.88	23.08	- 4.68	-14.90
Py	- 6.13	-20.01	- 0.42	- 4.31
Sa	5.58	-10.40	21.15	19.33
Ac	0.70	4.77	23.03	3.54
To	7.36	- 1.47	9.18	-42.57
So	- 8.28	- 2.84	7.30	-16.54
Ie	- 4.64	14.84	-19.20	10.45
Ai	5.54	-10.98	-20.81	7.36
Sc	9.70	18.31	-12.56	13.86

DISCRIMINANT VECTOR SCORE MEANS BY THREE ACHIEVEMENT GROUPS

GRADE NINE - LANGUAGE USAGE AND MAP READING

Language Usage				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	-2.86	-0.66	18.74	-0.63
Middle-achievers	-1.25	-0.09	20.78	0.16
High-achievers	1.61	0.98	19.63	-0.28
Combined Groups				
Mean	-1.01		20.36	
S.D.	2.78		2.56	

Map Reading				
Group	Discriminant Vector I		Discriminant Vector II	
	Mean Raw Score	Mean Z Score	Mean Raw Score	Mean Z Score
Low-achievers	4.36	0.89	3.44	0.28
Middle-achievers	1.66	-0.07	2.30	-0.16
High-achievers	0.42	-0.51	4.24	0.59
Combined Groups				
Mean	1.85		2.73	
S.D.	2.83		2.57	

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